Exploring Model Fit for the PISA Perceived Control Scale

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Programme for International Student Assessment (PISA)

- Measures a variety of academic and attitudinal constructs
- Perceived control new scale for the PISA 2012
- Will a mix of positively and negatively worded questions affect the validity of this new scale?

Research on Mixed Worded Items

- Factor loadings used to determine if a scale is measuring one unified construct
- Some research has found positively and negatively worded loading onto two different factors
  - (Barnette, 2000; Borgers, Sikkel, & Hox, 2004; Greenberger et. al., 2003)
- Mixed results on how these different loadings affect reliability
- Other mixed worded PISA scales have been analyzed
  - (Wang, Chen, & Jin, 2015).

Research on Perceived Control

- PISA Perceived Control Scale new; focus on math
- Variety of measures on the construct of perceived control
  - (Skinner, James, & James, 1990; Wellborn, Connell, & Skinner, 1989)
- Theological framework of how perceived control relates to behavior

Methods

- Correlated traits correlated methods (CTCM)
- PISA data for only United States students used
  - Sample size of 3,190
- Six Likert type items from strongly agree (value 1) to strongly disagree (value 4)
- Cronbach's alpha (a measure of internal reliability) of .638

Questions

Question label	Question Text	Coding
PC1	If I put in enough effort I can succeed in mathematics.	Reversed
PC2	Whether or not I do well in mathematics is completely up to me.	Reversed
PC3	Family demands or other problems prevent me from putting a lot of time into my mathematics work.	
PC4	If I had different teachers I would try harder in mathematics.	
PC5	If I wanted to I could do well in mathematics.	Reversed
PC6	I do badly in mathematics whether or not I study for my exams.	

Models Tested

- Single factor model: All items load onto 1 factor (that factor being perceived control)
- Two-factor without correlation model: Positively worded items will go on one factor while negatively worded items will go on another factor; factors are uncorrelated
- Two-factor with correlation model: Two factors but correlated
- Single factor with method effects: All questions load onto one factor but negatively worded items load onto a second factor as well

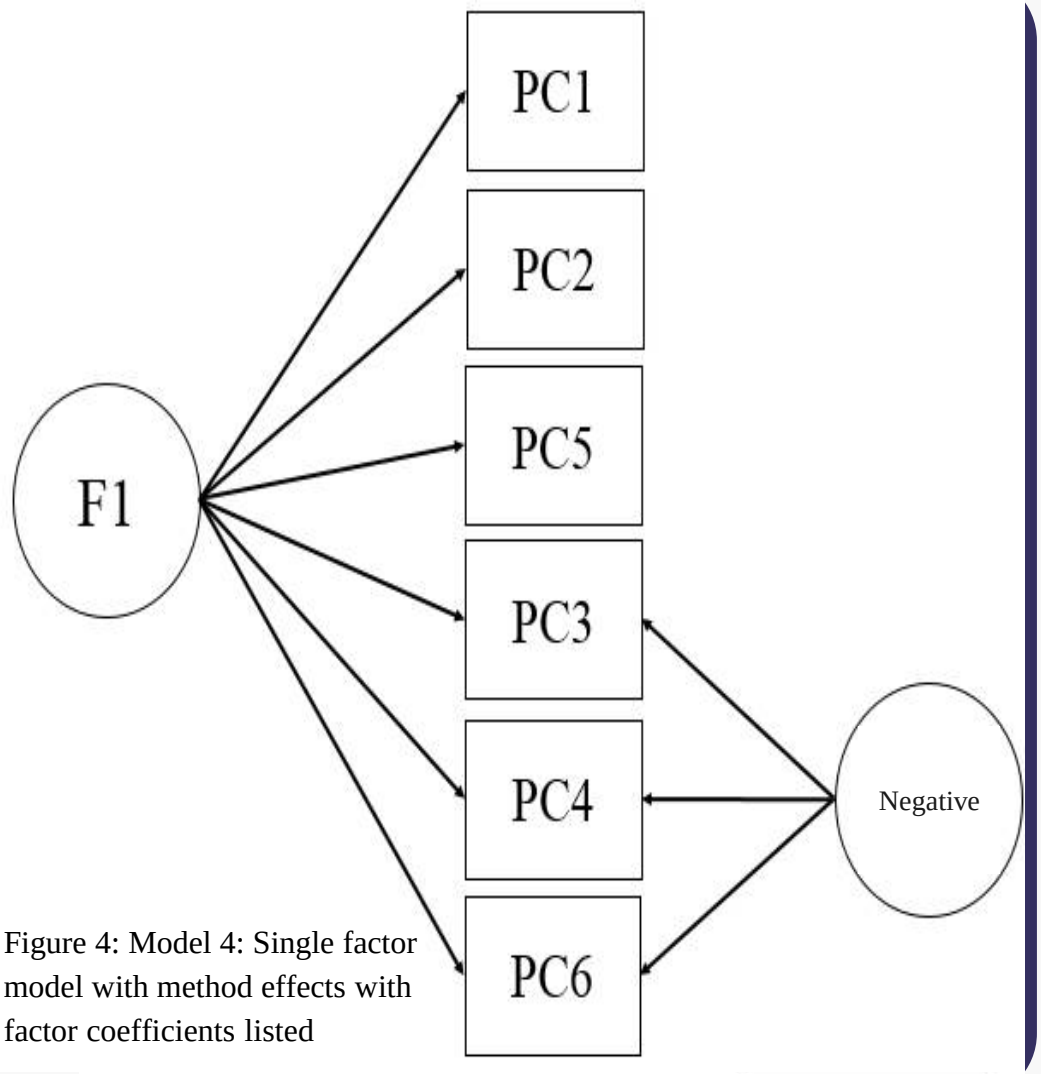

Figure 4: Model 4: Single factor model with method effects with factor coefficients listed

Model Fit

- Single factor model worst fitting model
- Two-factor without correlation model fit better and two-factor with correlation model was even a better fit than the uncorrelated model
- Best fitting model was the single factor model with method effects

Model	χ^2	*RMSEA*	*CFI*	*GFI*	*SRMR*	Model *AIC*
Model 1: Single factor model	739.91	0.160 (0.150, 0.169)	0.783	0.921	0.100	721.911
Model 2: Two-factor without correlation	390.93	0.115 (0.106, 0.125)	0.887	0.963	0.107	372.928
Model 3: Two-factor with correlation	209.68	0.089 (0.079, 0.099)	0.940	0.978	0.053	193.676
Model 4: Single factor with method effects	48.08	0.047 (0.035, 0.060)	0.988	0.995	0.017	36.076

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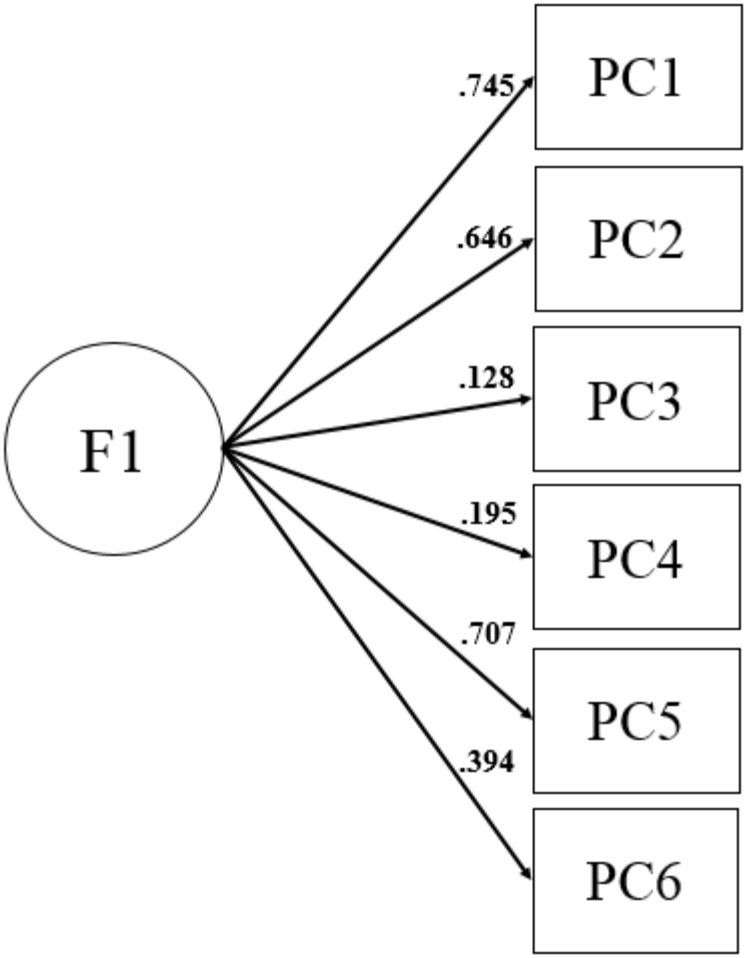

Figure 1: Model 1: Single factor model with factor coefficients listed

Model	χ^2	*RMSEA*	*CFI*	*GFI*	*SRMR*	Model *AIC*
Model 2: Two-factor model without correlation	390.93	0.115 (0.106, 0.125)	0.887	0.963	0.107	372.928

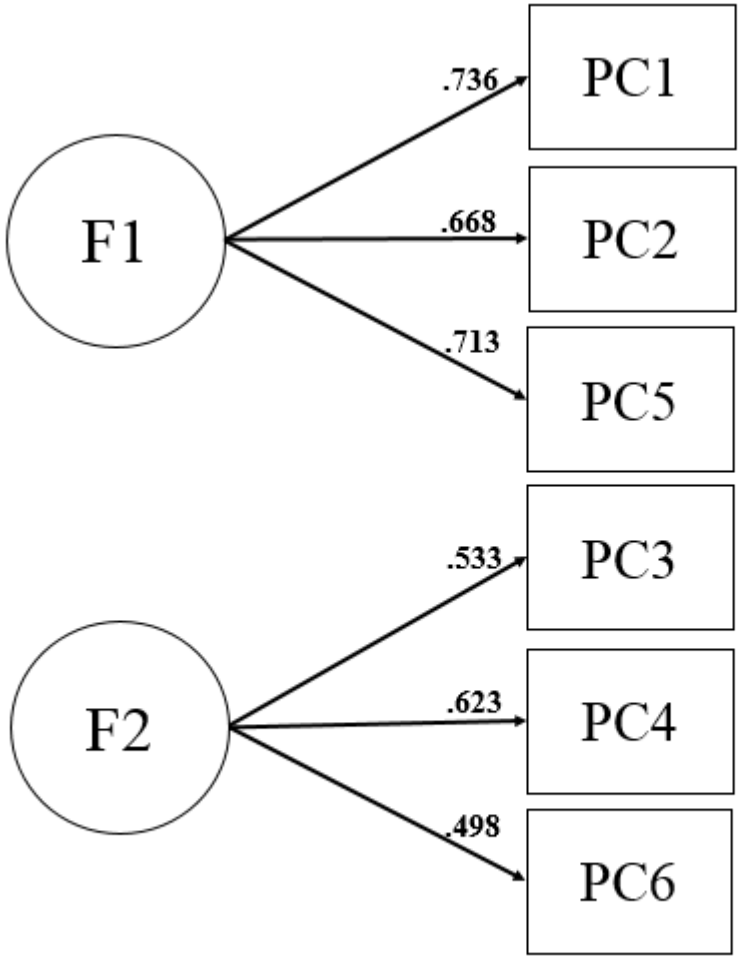

Figure 2: Model 2: Two-factor without correlation model with factor coefficients listed

Model	χ^2	*RMSEA*	*CFI*	*GFI*	*SRMR*	Model *AIC*
Model 3: Two-factor with correlation	209.68	0.089 (0.079, 0.099)	0.940	0.978	0.053	193.676

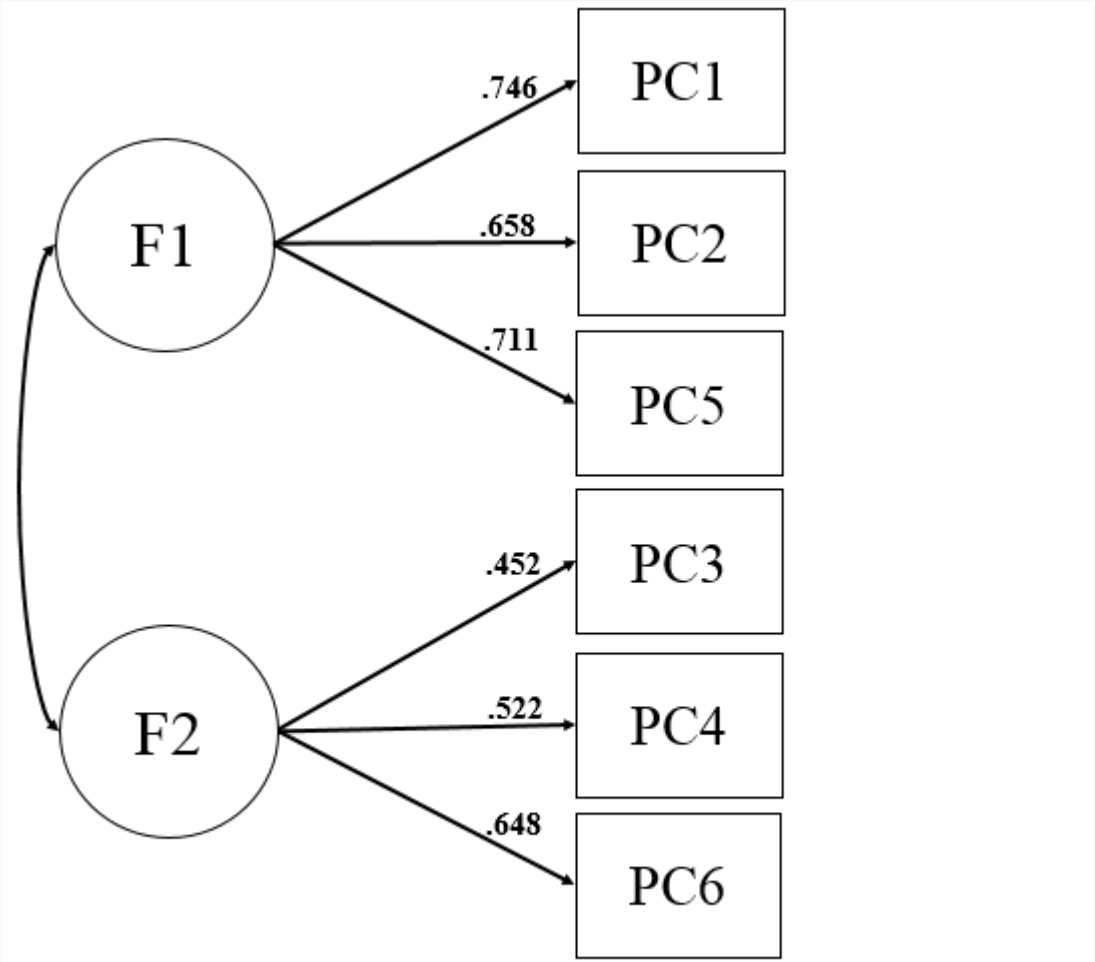

Figure 3: Model 3: Two-factor model with correlation with factor coefficients listed

Model	χ^2	*RMSEA*	*CFI*	*GFI*	*SRMR*	Model *AIC*
Model 4: Single factor with method effects	48.08	0.047 (0.035, 0.060)	0.988	0.995	0.017	36.076

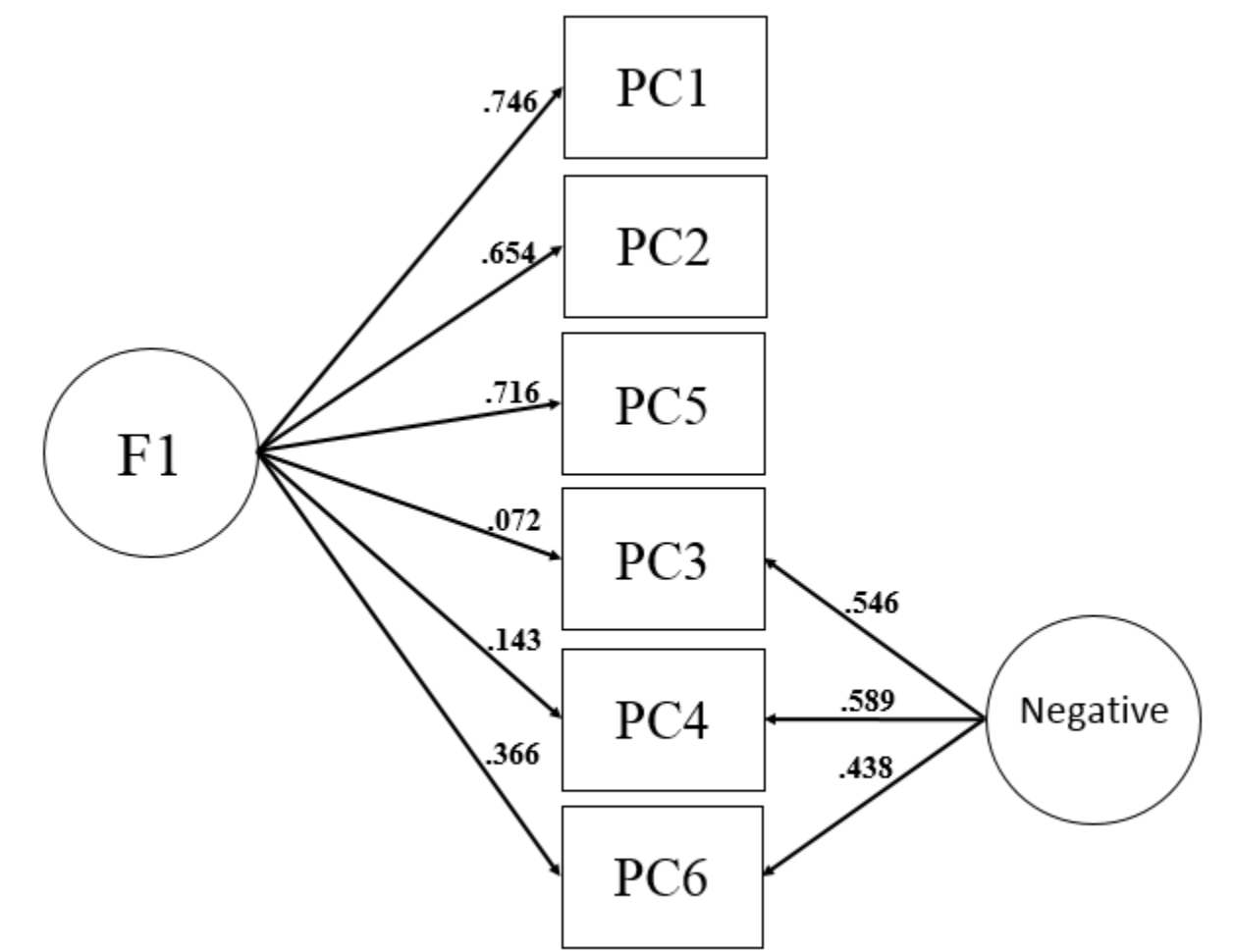

Figure 4: Model 4: Single factor with method effects with factor coefficients listed

Significance of Findings

- Data did not fit a single factor model well in this Perceived control scale
- Wording seemed to have an effect on how questions were answered
- Future studies may look to see how this scale is performing across countries

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