Testing Longitudinal Invariance of Parent Involvement in School using ECLS-K:2011

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Background

- Early childhood researchers are inherently interested in studying factors forecasting/ influencing children's outcomes at school. Parental involvement in education is one of them (Boonk, Gijselaers, Ritzen, & Brand-Gruwel, 2018). In ECLS-K: 2011, a large-scale longitudinal study, parents' involvement with their child's school was repeatedly measured across time. However, the psychometric properties of the items haven't been studied.
- Longitudinal measurement invariance assesses whether a construct has the same meaning and is measured on the same scale across time to ensure that change in observed scores over time can be attributed to actual changes in the construct under investigation (Millsap and Cham, 2012). This study aimed to test whether the items for parental involvement in school have the same meaning and are measured on the same scale over time.

Research Question

- Do the repeatedly measured items show longitudinal invariance over time? (Are the relations between the observed indicators and the latent constructs the same over time?)

Method

- The kindergarten to 3rd-grade student sample data was drawn from ECLS-K: 2011 (N=16035).
- School-based parent involvement was measured using parent reports for a count of parent involvement in school-based activities by binary responses for each activity (0 = No; 1 = Yes). There are five items that are measured repeatedly with exactly the same wording:
- u11-u41: ATTENDED BACK TO SCHOOL NIGHT (y/n)
- u12-u42: ATTENDED PTA/PTO MEETING (y/n)
- u13-u43: ATTENDED PARENT-TEACHER CONFERENCE (y/n)
- u14-u44: ATTENDED SCHOOL EVENT (y/n)
- u15-u45: VOLUNTEERED AT SCHOOL (y/n)

Method

- A series of confirmatory factor analysis models were run to examine the factor structure of parental involvement in school. For binary variables and weighted least squares estimation, only the configural (same factor structure) and scalar models are considered. Following the standard guideline for testing measurement invariance of categorical variables, a configural invariance model was set up and then was tested for scalar invariance (Muthén, & Muthén, 1998-2017).
- The configural model has factor loadings and thresholds free across groups, factor variances fixed at one at all times, and factor means fixed at zero at all times. The scalar model has factor loadings and thresholds constrained to be equal across groups, scale factors fixed at one time and free at other times, and factor means fixed at zero at one time and free at other times.

Measurement invariance of the construct was tested using multiple fit statistics including chi-square, CFI, RMSEA, and SRMR.

- In chi-square difference testing of measurement invariance, the chi-square value and degrees of freedom of the less restrictive model are subtracted from the chi-square value and degrees of freedom of the nested, more restrictive model. The chi-square difference value is compared to the chi-square value in a chi-square table using the difference in degrees of freedom between the more restrictive and less restrictive models. If the chi-square difference value is significant, it indicates that constraining the parameters of the nested model significantly worsens the fit of the model. This indicates measurement non-invariance.
- The weighted least-squares mean and variance adjusted estimator (WLSMV) and probit link function were used for data analysis. All analyses were conducted using Mplus version 8.4. Chi-square difference tests were run using DIFFTEST option of the program.

Result

- Since correlation analyses showed that the same items were highly correlated across time, residual covariances were included in the model.
- The results showed that scalar invariance was not achieved with given data Since full measurement invariance did not hold, partial measurement invariance was sought out. This involves relaxing some of the equality constraints on the measurement parameters (equality constraints on u14-u44; u15-u45).
- For categorical variables, equality constraints for thresholds and factor loadings for a variable should be relaxed at the same time. The backward method (sequentially releasing parameters) was used to identify noninvariant parameters (Putnick & Bornstein, 2016). Partial invariance was achieved.

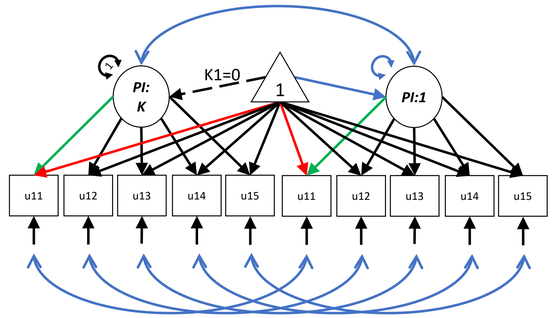

Figure 1. CFA model of Parent Involvement (T=2)

Discussion

- Evidence of partial invariance means we can evaluate longitudinal trajectories in parent-school involvement. This can tell us, e.g., whether parent involvement tends to dip during a certain grade, suggesting the need to implement strategies for increasing parent involvement. It also allows us to examine how changes in parent involvement over time relate to changes in student outcomes. These associations could inform interventions for struggling students.
- Non-full invariance indicates that the form/nature of parental involvement may change over time, e.g., parents involve themselves in different activities as children grow. Further investigation using frequency measures and qualitative methods would be necessary.
- Measurement invariance (or non-invariance) assessment across different demographic groups should also be evaluated to determine whether group comparisons of parental school involvement are meaningful.

Reference

- Boonk, Gijselaers, H. J. ., Ritzen, H., & Brand-Gruwel, S. (2018). A review of the relationship between parental involvement indicators and academic achievement. Educational Research Review, 24, 10–30. https://doi.org/10.1016/j.edurev.2018.02.001
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Table 1. Test of measurement invariance

Model	Chi-sq	CFI	RMSEA	SRMR	Model compared	Δ Chi-sq	Δ CFI	Δ RMSEA	Δ SRMR
M1: configural invariance	730.264 (134)	.992	0.017 (0.015-0.018)	0.03	-	-	-	-	-
M2: Scalar invariance	1185.199 (158)	.986	0.020 (0.019-0.021)	0.032	M1	360.284(24)	0.006	0.03	0.002
M2a: partial scalar invariance	731.275 (146)	.992	0.016 (0.015-0.017)	0.03	M1	42.118(12)	0	0.001	0