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Doubly-Latent Models of School Contextual Effects: Integrating Multilevel and Structural Equation Approaches to Control Measurement and Sampling Error

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Abstract

This article is a methodological-substantive synergy. Methodologically, we demonstrate latent-variable contextual models that integrate structural equation models (with multiple indicators) and multilevel models. These models simultaneously control for and unconfound measurement error due to sampling of items at the individual (L1) and group (L2) levels and sampling error due the sampling of persons in the aggregation of L1 characteristics to form L2 constructs. We consider a set of models that are latent or manifest in relation to sampling items (measurement error) and sampling of persons (sampling error) and discuss when different models might be most useful. We demonstrate the flexibility of these 4 core models by extending them to include random slopes, latent (single-level or cross-level) interactions, and latent quadratic effects.

Substantively we use these models to test the big-fish-little-pond effect (BFLPE), showing that individual student levels of academic self-concept (L1-ASC) are positively associated with individual level achievement (L1-ACH) and negatively associated with school-average achievement (L2-ACH)—a finding with important policy implications for the way schools are structured. Extending tests of the BFLPE in new directions, we show that the nonlinear effects of the L1-ACH (a latent quadratic effect) and the interaction between gender and L1-ACH (an L1 × L1 latent interaction) are not significant. Although random-slope models show no significant school-to-school variation in relations between L1-ACH and L1-ASC, the negative effects of L2-ACH (the BFLPE) do vary somewhat with individual L1-ACH.

We conclude with implications for diverse applications of the set of latent contextual models, including recommendations about their implementation, effect size estimates (and confidence intervals) appropriate to multilevel models, and directions for further research in contextual effect analysis.

Notes

[a]The Mplus Web site (http://www.statmodel.com/index.shtml) contains the syntax for all 10 models and a more general description of Mplus convention for specifying the models (http://www.statmodel.com/ugexcerpts.shtml)

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