Level-1 variance: HGLM models

In the case of a multilevel model for a dichotomous outcome, there is no unique decomposition or variance at level-1. The level-1 variance depends on the covariates even if you have a single random effect.

Consider the example of a binomial model shown in the of the HLM manual:

For a binomial model with $n_{ij} > 1$, a cross-classification of students by gender and pre-primary education implies four cells, each with unique cell size n_{ij} and cell count Y_{ij}. The study can be considered to have four level-1 units (cells), with the outcome Y_{ij}, given the cell probability ϕ_{ij}, distributed as $B\left(n_{ij}, \phi_{ij}\right)$.

In the metric of the linearized dependent variable, the level-1 variance is the reciprocal of the binomial variance,

$$n_{ij} \phi_{ij} (1 - \phi_{ij}).$$

It is possible to rewrite such a model as a threshold model with a latent continuous variable, and then to calculate the decomposition of variance with respect to the latent variable. See Hedeker & Gibbons (1994) in Biometrics for more on random effect threshold models.