

## Level-1 variance in the case of a dichotomous outcome

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  $\phi_{ij}$ , distributed as  $B(n_{ij}, \phi_{ij})$ .

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.