Cross – classified questions

1. Do these models apply for other kinds of outcomes (e.g., binary, ordinal, counts)?

Yes, but other statistical software programs would be necessary. For example, in SAS one could use PROC GLIMMIX for other outcome types.

1. Is it possible to model data where some subjects are fully nested (e.g., students in schools) and others are cross-classified (e.g., students within a crossing of groups and schools)?

Yes, such data are called partially cross-classified multilevel data, and a modeling approach is described in the following article, which includes sample code in its appendix.

Luo, W., Cappaert, K.J. and Ning, L. (2015), Modelling partially cross-classified multilevel data. Br J Math Stat Psychol, 68: 342-362. https://doi.org/10.1111/bmsp.12050

Based on simulations, they write “Modelling partially cross-classified data with the fully nested model and the fully crossed model results in biased parameter estimates.”

1. What is the impact of inappropriate modeling of cross-classified data?

This topic was investigated in the following paper:

Jason L. Meyers & S. Natasha Beretvas (2006) The Impact of Inappropriate

Modeling of Cross-Classified Data Structures, Multivariate Behavioral Research, 41:4, 473-497,

DOI: 10.1207/s15327906mbr4104\_3

These authors provided an illustrative example and performed a simulation study. From the simulation study, they concluded: “Results indicated that when the structure is ignored, fixed-effect estimates were unaffected, but standard error estimates associated with the variables modeled incorrectly were biased. Estimates of the variance components also displayed bias, which was related to several study factors.”

1. What is the impact of ignoring multiple membership data structure when it exists?

This was investigated in:

Chung, H. and Beretvas, S.N. (2012), The impact of ignoring multiple membership data structures in multilevel models. British Journal of Mathematical and Statistical Psychology, 65: 185-200. <https://doi.org/10.1111/j.2044-8317.2011.02023.x>

In this paper, they used simulation with students (level-1) clustered within schools (level-2), with the condition that some students were members of multiple schools (either 10% or 20% of the students). Their results indicated that standard multilevel modeling of such data (using the last school that a student attended, rather than all schools and a mult-membership model) resulted in biased estimates of the cluster-level (level-2) covariates, as well as biased estimates of both level-1 and level-2 variance parameters.

1. What is the impact of ignoring interaction between the crossed factors when it is present?

This was examined in:

Shi Y, Leite W, Algina J. The impact of omitting the interaction between crossed factors in cross-classified random effects modelling. Br J Math Stat Psychol. 2010 Feb;63(Pt 1):1-15. doi: 10.1348/000711008X398968.

They report: “Results from a Monte Carlo simulation study indicate that, for fixed effects, both coefficients estimates and accompanied standard error estimates are not biased. For random effects, results are affected at level 2 but not at level 1 by the presence of an interaction variance and/or a correlation between the residual of level two factors.”