Fitting Multidimensional IRT Models with R

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Item response theory (IRT) is widely used in assessment and evaluation research to explain how participants respond to questions. IRT assumes that people respond to a test item according to their ability and the difficulty of the item. From the statistical point of view, IRT models are mixed-effects models because the difficulty of the items is a fixed effect, whereas the person ability is considered as a random effect. Currently, several R packages can be used to fit various IRT models. For example, the ltm package (Rizopoulos, 2006) can handle the Rasch model, the latent trait model, the three-parameter model, and the graded response model; and the eRm package (Mair & Hatzinger, 2007) can fit the rating scale model and the partial credit model. These packages, however, can only analyze unidimensional IRT models.

Multidimensional IRT models have been proposed to account for multilevel or hierarchical data, in which subjects may be grouped into clusters and items may be nested within different dimensions. The lme4 package can be used to analyze multidimensional Rasch models for dichotomous outcomes (Doran, Bates, Bliese, & Dowling, 2007). For categorical responses, fitting multidimensional IRT models requires using commercial software such as SAS or Conquest. The paper presents an implementation of multidimensional IRT models for categorical outcomes in R and demonstrates its use with an illustrative example.

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