

Electronic Supplementary Material 1

Electronic Supplementary Material 1 explains the multidimensional partial credit model (MPCM) using the notation introduced by Kelderman (1996). In the MPCM, s trait parameters θ_{jq} ($q = 1, \dots, s$) exist. ω_{qiy} is an indicator variable pre-specified by the researcher which reflects the assignment of items to dimensions. It takes the value 1 if the response to an item measures dimension q and 0 if it does not. The MPCM then models the probability (π_{ijx}) that a person j with trait levels θ_{jq} on the s dimensions will respond in category x ($x = 1, \dots, r$) of item i as

$$\pi_{ijx} = \frac{\exp \left[\sum_{y=1}^x \left(\sum_{q=1}^s \omega_{qiy} \theta_{jq} - \delta_{iy} \right) \right]}{1 + \sum_{z=1}^{r_i} \exp \left[\sum_{y=1}^z \left(\sum_{q=1}^s \omega_{qiy} \theta_{jq} - \delta_{iy} \right) \right]}. \quad (1)$$

In Equation 1, δ_{iy} denotes the threshold parameter between two response categories $x=y-1$ and $x=y$. When $s = 1$ and for all items $\omega_{qiy} = 1$ in Equation 1, the unidimensional PCM results.

Reference

Kelderman, H. (1996). Multidimensional Rasch models for partial-credit scoring. *Applied Psychological Measurement*, 20(2), 155-168. doi:10.1177/014662169602000205