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Evaluating competence models with cognitive diagnosis models

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Abstract

The Hierarchical Diagnostic Classification Model (HDCM) reflects on the sequences of the presentation of the required Assessment tests are based on different assumptions regarding the tested domain. On the one hand, subject-related instructional assumptions determine the number and structure of competencies describing the domain to be assessed. These assumptions impact, for instance, the guidelines for and processes of item development. On the other hand, empirical modeling and reporting are based on statistical assumptions regarding the assessed competencies. Perhaps because of interdisciplinary differences between the responsible specialists, the listed assumptions may not be in line with one another. Specifically, this is true for large-scale assessment studies like the Progress in International Reading Study (PIRLS) or the Trends In Mathematical and Science Study (TIMSS), measuring reading or mathematical competencies of students respectively. Cognitive diagnosis models (CDMs) provide the opportunity to represent each assumption in terms of a statistical model (i.e. a member of the CDM family). Based on assessment data, the different models (and thus the different assumptions) may then be compared and evaluated. The instructional assumptions describing the model that fits the data best may then be used for further research as e.g. feedback or teaching methodology.

In my talk, I will explicate these thoughts (George, Robitzsch, Krelle, & Breit, 2019) for the PIRLS 2016 study. Assumptions deduced from the subject-related competence model (Irwin, 1986), instructional literature in the field of reading competence, PIRLS item writing guidelines (Voss, Carstensen, & Bos, 2005, p. 21) and the reported categories (Mullis, Martin, Foy, & Hooper, 2017, p. 52

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f.) support a number of statistical models: a unidimensional hierarchical model, a two-dimensional, a four-dimensional and a complex eight-dimensional model. By reducing the number of possible skill classes, the different assumptions (e.g. the hierarchy) are modeled (Leighton, Gierl & Hunka, 2004). The different models are fitted to Austrian students responses to the PIRLS items and compared in terms of different fit criteria. An expansion of the presented study approach for the international dataset and possible implications are discussed.

References

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