

WORKSHOP ON COGNITIVE DIAGNOSIS MODELS 2019 (CDM2019) –
DORTMUND – 25./26.7.2019

Application and validation of a CDM in a large-scale formative assessment in mathematics prediction and confirmation of item difficulties

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Abstract

An educational assessment should support a decision about what might be useful to do next. If large-scale assessment is designed to serve this formative purpose, then it has to be grounded in empirically based cognitive models of learning and to be focused on well-defined and fine-grained aspects of competence. This is exemplified by the large-scale formative assessment Lernstand 5 in the German state Baden-Württemberg with more than 80 000 students participating each year in the beginning of grade 5. The assessment comprises three separate areas of competence and is based on three correspondingly defined diagnostic competence models, number sense, operation sense, and calculation algorithms. The oral presentation discusses the theoretical background and evidence of validity for the diagnostic competence model about childrens operation sense that describes students operation sense on four distinct levels. On each level, the model elaborates on the characteristics of tasks that students on this level are able to answer correctly. Moreover, the model explains this by referring to two kinds of cognitive processes that are supposed to be necessary to respond to these kinds of tasks successfully. In a validation study (N = 4960), about 85% of the variance in the item difficulties (84 items, booklet design; linear regression on Rasch estimated item parameters, and complementary: Linear Logistic Test Model) was explained by the four, a priori allocated, levels of operation sense.

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