ASSESSMENT OF EARLY ARITHMETIC CONCEPTS IN BILINGUAL LEARNERS

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Aims: Within the context of training for early numeracy, a valid and culture fair assessment of concepts is crucial for the design of teaching (Räsänen et al., 2019). As particularly in bilingual learners linguistic influences can affect test results (Prediger et al., 2019), we aim at presenting the adaption of the German MARKO-S (Ehlert, Ricken & Fritz, in press) for bilingual German/Turkish learners (Gürsoy et al., in press).

Theoretical framework: Fritz et al. (2013; 2018) describe children's learning trajectories for preschoolers as well as grades 1 and 2 in a hierarchical sequence of six levels. This theory-based and empirically validated developmental model of arithmetic concepts serves as basis for diagnostic devices (Ricken et al., 2013; Fritz et al., 2017) including the screening device MARKO-S (Ehlert et al., in press).

The MARKO-S covers in a total of 21 items the first three levels of the model. As bilingual learners might be disadvantaged by language biases when assessed in German only, a German-Turkish version of the MARKO-S was designed and validated (Gürsoy et al., in press).

Method: Arithmetic concepts of a total of N=91 children (52 girls, M_{age}=76.82 months, SD_{age}=6.07 months) were assessed with the bilingual screener in German and Turkish (Gürsoy et al., in press). All children were German-Turkish bilinguals. To cover the whole application range, the sample comprises preschoolers (N=50) and first-graders (N=41).

Children's responses in both languages were analyzed in a common dichotomous Rasch-model. As the model by Fritz et al. (2013; 2018) proposes a hierarchy of conceptual levels, items operationalizing the same concepts are supposed to show similar difficulties and cluster consistently while the hierarchy of the clusters should mirror the level sequence (Fritz et al., 2018).

Results: All MNSQ-infit values for the common Rasch-analysis are between .80 and 1.24 and are thus satisfying (Linarce & Wright, 1994). Although a few items slightly differ from their expected difficulty, the results of the Rasch-analysis generally underpin the model hierarchy for bilingual learners. Remarkably, similar items in both languages show very similar difficulties.

Discussion: The study underpins that arithmetic concepts can be assessed bilingually. This provides first evidence that the model by Fritz et al. (2013; 2018) is particularly valid for German-Turkish bilinguals. Since the item difficulties in the two languages match, it can be assumed that bilingual learners develop arithmetic concepts in both languages in parallel (Gürsoy et al., in press; Kuzu & Prediger, 2017; Moschkovich, 2007). Thus, teaching can use bilingual arithmetic concepts as a resource in class. However, the rather small sample and ceiling effects in this study urge caution in interpretation.