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Students' competencies in working with functions in secondary mathematics education – empirical examination of a competence structure model.

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Summary: In the subject matter of functional relationships, a student's ability to translate from one form of representation to another is seen as a central competence. In the course of the HEUREKO project (heuristic work with representations of functional relationships and the diagnosis of mathematical competencies of students), a theoretical competence structure model comprising five competence dimensions was developed. These are based on four types of representation (graph, numerical table, algebraic equation and situational description) and correspond to the skill to translate from one type of representation to another. The following study was aimed to examine the facets of the model. The 5-dimensional model was empirically tested with a sample of $N = 645$ students of grades 9 and 10. This was accomplished by comparing competing item response models with regard to model fit using information criteria measures. In comparison with other possible model structures, our postulated 5-dimensional model showed the best model fit, suggesting that all translations are relevant for competence assessment and development. Furthermore, in order to allow for the identification of structural components of cognitive actions, the employed tasks used in the empirical testing were divided into categories with regard to the different demands of cognitive action. Our results suggest that cognitive actions may have a specific dimensional structure. These findings can contribute to a better diagnostic approach concerning specific strengths and weaknesses and can therefore foster students' competencies.

Classification: I23 C43

Keywords: change of representation; competence structure model; elements of cognitive action; item response theory; representations of functional relationships

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