

THE INFLUENCE OF LANGUAGE COMPREHENSION ON NUMERACY LEARNING IN FIRST GRADE

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Different aspects of language comprehension have shown a strong connection with mathematical skill development. These include phonological awareness (Alloway et al., 2005; Grube & Hasselhorn, 2006; Passolunghi et al., 2007), expressive language (Mücke, 2007) and reading skills (Prediger, 2010). To what extent do sentence and instruction comprehension influence numeracy learning over the course of the first grade? To what extent do learning progressions differ between groups on different levels of language proficiency? A longitudinal study with N=103 first-grade students was conducted. Pre-testing at the beginning of the school year assessed numerical concepts comprehension via the MARKO-D test, and language comprehension via the two subscales of the MSVK test (Sentence and Instructions Comprehension). Cognitive capabilities were assessed via the CFT 1-R test. Approximately two months after pre-testing, a trial progress monitoring measure was applied to assess numeracy development over an eight-month period with one measurement per month. At the end of the school year, numerical concepts comprehension was re-assessed using the MARKO-D1 test. Item-fit analysis showed acceptable to very good infit values between .8 and 1.2. Using pre-test data, a stepwise linear regression was conducted with 'arithmetical competencies' as the dependent variable and 'language competencies' and 'cognitive capabilities' as independent variables. Linear regression showed 56% explained variance for arithmetical competencies. All predictors showed significant beta-coefficients. No multicollinearity was found. Students were divided into two groups (low: N=6 versus high: N=26) based on performance in the instructions comprehension scale. A variance analysis with repeated measures showed a significant main effect for measurement point, $F_{(1,30)}=6.508$, $p<.001$, $\text{part.}\eta^2=.18$, and a significant main effect for group assignment, $F_{(1,30)}=15.729$, $p=.001$, $\text{part.}\eta^2=.34$, but no significant interaction effect was found. Influences of language comprehension, cognitive capabilities, and initial levels of numeracy comprehension as assessed in the pre-test, were also investigated on the post-test score for numeracy comprehension. The stepwise linear regression explained 51% of the variance of the numeracy comprehension in the post-test. In this model the beta-coefficients of only the numeracy comprehension and cognitive capabilities were significant. Results indicated a meaningful influence of language comprehension on numeracy learning. However, after including numeracy comprehension in the model, only cognitive capabilities and the initial numeracy comprehension explained the numeracy comprehension assessed in the post-test at the end of first grade. Comparing the language proficiency groups, both progressed similarly over time.