

PLAYFUL INTERVENTION FOR EARLY NUMERACY IN PRESCHOOLERS

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Aims: A broad and still growing body of empirical research has provided evidence for the importance of children's early numerical knowledge for their later learning outcomes (Aunola et al., 2004; Aunio & Räsänen, 2016; Lyons et al., 2014). While formal interventions can help these children to develop these concepts, playful activities are still rare (Chodura et al., 2015; Gerlach et al., 2013). In this paper we present a playful intervention for early numeracy and its evaluation in preschoolers.

Theoretical framework: Fritz et al. (2013; 2018) designed and empirically validated a developmental model of arithmetic concepts that describes children's individual learning trajectories during preschool as well as grades 1 and 2 in six hierarchical levels.

Based on this model, Fritz and Herzog (2018) designed a playful intervention that integrates the aspects of a usual memory game with numerical instruction. Up to 20 objects or pictures are presented in different structures that allow their recognition without counting (McCandliss et al., 2010). Specific activities for each level of the model by Fritz and colleagues aligned playful fostering to the children's individual conceptual knowledge.

Method: An experimental group of $N=26$ (12 girls, $M_{age}=65.42$ months, $SD_{age}=4.46$ months) learners played the game with two trained instructors. Over a time of 6 weeks children received 9 to 12 sessions ($M=10.12$, $SD=.82$) of 20 minutes each. A passive control group ($N=26$, 15 girls, $M_{age}=66.11$ months, $SD_{age}=4.12$ months) was tested like the experimental group but did not receive any special treatment.

In a usual pre-post-test design, the numerical concepts following Fritz et al. (2013; 2018) of both groups were assessed before and after the intervention with a screening covering the first three levels of the model.

Results: In ANOVAs with repeated measurement both groups showed significant growths in performance with a clearly bigger effect size in the intervention group. While the control group started with slightly better performance, the intervention group could catch up during the study. The effect of the intervention ($d=.45$) is within the 'zone of desired effects' (Hattie, 2009).

The raw score means of both groups in pre- and posttest:

Intervention group, $N=26$: Pre-M: 11.58, SD: 3.73; Post-M: 15.19; SD: 4.17;

ANOVA (repeated measurement): $F_{(1,25)}=80.036$, $p<.001$, part. $\eta^2=.762$

Control group, $N=26$: Pre-M: 13.12, SD: 3.49; Post-M: 15.12, SD: 4.00, ANOVA (repeated measurement): $F_{(1,25)}=19.118$, $p<.001$, part. $\eta^2=.443$

Discussion: The evaluation study shows that not only highly formalized, but also rather playful interventions can promote early numerical development. A follow-up study is planned.

As the effect size is satisfying yet rather small, this game-based intervention might hardly serve as a single treatment for low performing children, but can be a good tool to accompany formal intervention as well as a regular activity for all children.