

# **Early enhancement of kindergarten children potentially at risk in learning school mathematics – Design and findings of an intervention study**

Andrea Peter-Koop, University of Bielefeld, IDM

Meike Grüßing, IPN, Kiel

Recent psychological studies as well as research findings in mathematics education highlight the significance of early number skills for the child's achievement in mathematics at the end of primary school.

While most preschoolers manage to develop a wide range of informal knowledge and skills in early numeracy, there is a small number of children who for various reasons struggle with the acquisition of knowledge about numbers (Clarke, Clarke, Grüßing & Peter-Koop 2008). Furthermore, clinical psychological studies suggest that children potentially at risk learning mathematics can already be identified one year prior to school entry by assessing their number concept development (Krajewski 2005; Aunola, Leskinen, Lerkkanen & Nurmi 2004). Findings from these studies also indicate that these children benefit from an early intervention prior to school, helping them to develop a base of knowledge and skills for successful school-based mathematics learning. This seems to be of crucial importance as findings from the SCHOLASTIK project (Weinert & Helmke 1997) suggest that students who are low achieving in mathematics at the beginning of primary school in general tend to stay in this position. In most cases, a recovery does not occur. In addition, Stern (1997) emphasises that subject-specific knowledge prior to school is more important with respect to success at school than general cognitive factors such as intelligence.

In this context, the three-year longitudinal study (2005-2008) that provided the background of this paper, seeks to investigate the effects of an intervention in the year prior to school (5-year-old children) for children potentially at risk in learning mathematics on their later achievement in mathematics at the end of grade 1 and grade 2. The study aims

- to determine how 5-year-old kindergarten children potentially at risk in learning school mathematics can be identified one year prior to them starting school,
- to implement an early intervention following two approaches – weekly one-on-one intervention by pre-service teachers versus (small) group intervention by the kindergarten teacher,
- to investigate possible effects of the intervention on children's number skills at the beginning of school, at the end of year 1 and year 2.

While key results with respect to the effects of the intervention on student achievement immediately before school after grade 1 and grade 2 have already been reported elsewhere (Peter-Koop, Grüßing & Schmitman gen. Pothmann 2008; Grüßing & Peter-Koop 2008), the aim of this paper is to explore how children potentially at risk learning school mathematics can be supported effectively in terms of their number concept development in early childhood education at kindergarten through an early intervention.

Hence, following an overview of the theoretical background as well as of the design and diagnostic instruments used in the study, a detailed description of the intervention and its focus on games and play-type activities is given before key findings of the study are summarized and discussed.

- Clarke, B., Clarke, D., Grüßing, M. & Peter-Koop, A. (2008). Mathematische Kompetenzen von Vorschulkindern: Ergebnisse eines Ländervergleichs zwischen Australien und Deutschland. *Journal für Mathematik-Didaktik*, 29(3/4), 259–286.
- Grüßing, M. & Peter-Koop, A. (2008). Effekte vorschulischer mathematischer Förderung am Ende des ersten Schuljahres: Erste Befunde einer Längsschnittstudie. *Zeitschrift für Grundschulforschung*, 1 (1), 65–82.
- Krajewski, K. (2005). Vorschulische Mengenbewusstheit von Zahlen und ihre Bedeutung für die Früherkennung von Rechenschwäche. In M. Hasselhorn, W. Schneider, & H. Marx (Eds.), *Diagnostik von Mathematikleistungen* (pp. 49–70). Göttingen: Hogrefe.
- Peter-Koop, A., Grüßing, M. & Schmitman gen. Pothmann, A. (2008). Förderung mathematischer Vorläuferfähigkeiten: Befunde zur vorschulischen Identifizierung und Förderung von potenziellen Risikokindern in Bezug auf das schulische Mathematiklernen. *Empirische Pädagogik*, 22 (2), 208–223.
- Stern, E. (1997). Ergebnisse aus dem SCHOLASTIK-Projekt. In F.E. Weinert & A. Helmke (Eds.), *Entwicklung im Grundschulalter* (pp. 157–170). Weinheim: Beltz.
- Weinert, F. E. & Helmke, A. (Eds.) (1997). *Entwicklung im Grundschulalter*. Weinheim: Beltz.