Examining the Effects of Number Sense Instruction on Mathematics Competence of Kindergarten Students

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Abstract: This study examined the impact of number sense instruction and general classroom instruction on the development and maintenance of mathematics skills of kindergarten students. Participants included kindergarten students from nine classrooms in two elementary schools located in suburban school districts in northeastern United States. The nine classrooms (N = 135) were randomly assigned to either the intervention (Number Sense, NS) group or the comparison (General Classroom Instruction, GCI) group. Overall, results indicated that both groups made significant improvements and maintained them overtime.

Keywords: Number Sense, Kindergarten.

1. Introduction

A strong conception of number and the quantity it represents is a critical part of all areas of daily life. Despite the importance of mathematics competence in daily life, mathematical difficulties are widespread (Doughtery, 2003; Gross-Tsur, Manor, & Shalev, 1996; Murmane, Willett, & Levy, 1995; Ostad, 1998). In addition, there is insufficient research to inform us about instructional approaches that best address the needs of students who are at risk for mathematics failure (Baroody, 1991; Francis, Rivera, Lascaux, Kieffer, & Rivera, 2006; Gersten & Chard, 1999). Despite broad-based concern and a clear direction for reform, progress has been relatively slow, particularly in relation to objectives such as enhancing number sense and lowering the performance gap between advantaged and disadvantaged children (Griffin & Case, 1997). Thus, it is important to design effective interventions for children who are developing or likely to develop problems in mathematics (Dowker, 2005).

Competence in mathematics depends heavily on appropriate and effective instruction, and on opportunities to learn. There are skills that must be developed in the early years (as early as kindergarten) for success in mathematics. Similarly, there is evidence that early intervention can prevent significant difficulties for many learners (Berc, & Mazzocco, 2007; Gersten, Jordan, & Flojo, 2005), and number sense is one of the most important skills necessary for success with basic mathematical computations in the early grades (Berc, 2005; Gersten & Chard, 1999). The term number sense is often used as an umbrella term to describe a well-developed understanding of the concept of number. It refers to "a person's general understanding of number and operations along with the ability and inclination to use this understanding in flexible ways to make mathematical judgments and to develop useful strategies for handling numbers and operations" (Mcintosh, Reys, & Reys, 1992, p. 3). It also reflects students' early experiences, as well as their cognitive facility (Dowker 2005; Lipton & Spelke, 2003). Researchers believe that a firm understanding of numbers and number systems is central to math learning and that instruction including number sense activities leads to significant reductions in early mathematics failure (e.g., Griffin, Case, & Siegler, 1994).

Given that number sense serves as the foundation for learning formal math concepts and skills, it seems essential to identify interventions, specifically acquisition and/or development of number sense, that support students early in order to prevent later failure in mathematics. Research clearly indicates that lack of number sense can causally affect students' mathematics performance.