Response To Intervention (RTI) in Number sense – Developing a method supporting students at risk in a Swedish context

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This presentation focuses a project on identifying and supporting students at risk of falling behind in their learning of number sense in early school years (from grade 1). Response To Intervention (RTI) is used as a model for monitoring and supporting students at risk in a staged series of research-based interventions focusing on number sense. In this project 113 students' number sense has been monitered from grade 1 to the end of grade 2. Students at risk have participated in tier 2 and tier 3. A control group of 37 students has been monitered. Tentative results indicate significant differences on group level where the intervention group show fewer students left behind.

This short presentation reports on a Response To Intervention (RTI) project focusing number sense. The overall aim of the project was to identify and support students at risk of falling behind in their learning of mathematics from grade 1 (7-year-old students). Hence, a model based on RTI was implemented to investigate if it is a fruitful way of identifying and supporing number sense in early school years. The intent in the RTI-model is that students' learning needs should be identified and addressed early by fitting interventions and support. This is a contrasting approach to the traditional way of handling special needs education - the student attends school, fails after a few years, then potential learning disabilities are examined, and the student is supported in special needs education (Fletcher et al., 2004). Instead, the aim of RTI is to prevent student failure and enhance the education to meet the needs of all the students. It reduces the number of students in segregated placements and time in special education. RTI has its differences from special needs ideology and inclusion in its original form, since it has a focus on prevention *before* failure, pro-active. RTI has been substantially used in an American context (e.g., Bryant et al., 2011). RTI consists of stages with monitoring and support of students at risk in a staged series of interventions. In the project presented in this short presentation, RTI has been adapted to a Swedish context, and the interventions address number sense. This implies cultural and situational aspects have been taken into consideration. The stages of RTI (called tier) have been used as a core in the project. At stage 1 (tier1) all students are in the classroom and the mathematics teachers have a proactive education with research-based instruction. This begins when the students start school in grade 1. At stage 2 (tier 2) students not responding to tier 1, and at risk of falling behind in their learning are identified. These students get small group instructions with a special teacher in mathematics using research-based instruction and materials. In tier 3 students not responding to tiers 1 and 2 are getting intensive individualized support

with one-to-one interventions. All through the tiers, the students are frequently monitored by two tests, one test measuring number sense and one test measuring automatization of addition and subtraction in number range 1-20. This is in this project regarded as a core of number sense, which is presented in the following section.
Number sense, and what it consists of, has been of interest in research for decades. Even though it is a concept commonly used within mathematics education, it is by definition elusive. As Griffin (2004) points out, we all know number sense when we see it, but it is hard to easily describe what it is, yet this is what we need to know to be able to teach it. Often when referring to number sense, research from the 70-ties is referred to (Gelman & Gallistel, 1978) using five principles guiding learning in mathematics. 1. Understanding the verbal sequence of counting, 2. One-to-One Correspondence, 3. Cardinality, 4. Abstraction, 5. Order Irrelevance. Another part of number sense identified recently is applied number sense which refers to how students can use their knowledge of handling numbers in everyday life (Sayers & Andrews, 2015). Deriving from this, Seyers et al. (2016) defines foundational number sense (FoNs) as a non-innate number-related competence typically taught during the first years of schooling. Seyers et al. (2016) has summarized eight key components of FoNs; number recognition, systematic counting, awareness of the relationship between number and quantity, quantity discrimination (an understanding and comparisons of magnitudes), different representations of numbers, estimation, simple arithmetic competence and awareness of number patterns. It is these eight components that are in focus in this project, in the teaching in tier 1, in the interventions in tier 2 and 3, and the tests used for monitoring and identifying students at risk. In this project 113 students number sense has been monitered from grade 1 to the end of grade 2. Students at risk have participated in tier 2 and tier 3. Also, a control group of 37 students has been monitered. Tentative results indicate significant differences on group level where the intervention group show a more collected result with fewer students left behind.

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