Can Early Number Sense Interventions in Combination with a RTI Approach Help Prevent Math Failures?

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Purpose

Extensive research and intervention programs exist for language based learning difficulties. Nevertheless, mathematical learning difficulties are also very common. Many students fail to acquire the necessary math skills to succeed within, and later on, outside of the classroom. Research supports the importance of early identification of students who are experiencing academic difficulties. The present project combines the Response to Intervention (RTI) approach with early number sense interventions in order to identify and support students who enter kindergarten with a lack of number sense (NS).

Theoretical Perspective

Number sense is a concept that describes the informal or intuitive understanding of numbers that children display prior to formal schooling. Some children enter school lacking this basic understanding of number sense which can negatively affect their future acquisition of mathematical knowledge (Howell & Kemp, 2009). Many studies have identified the importance of phonemic awareness for the development of reading skills. Instruction in phonemic skills leads to enhanced reading performance and measures of phonemic awareness are good predictors of early reading performance. Number sense is as important for learning mathematics as phonemic awareness is for reading (Gersten & Chard, 1999).

Phonemic Awareness	Number Sense
• Influenced by environment	• Informally acquired prior to entering school
• Reading predictor	• Math performance predictor
• Instruction enhances performance	• Instruction improves performance
• Necessary for learning to read	• Necessary for learning arithmetic skills
• Early intervention has better effects	• Early intervention effective

Table 1

Response to intervention starts as early as kindergarten and offers support based on a student's level of responsiveness to increasingly intensive interventions. The RTI approach is very successful due to the continuous assessment of the student's progress and the individualized programming. Reading interventions are often implemented or combined with the RTI delivery model. On the other hand, interventions that combine a math program with the RTI approach are less common and implementation of that combination in schools is rare.

Project

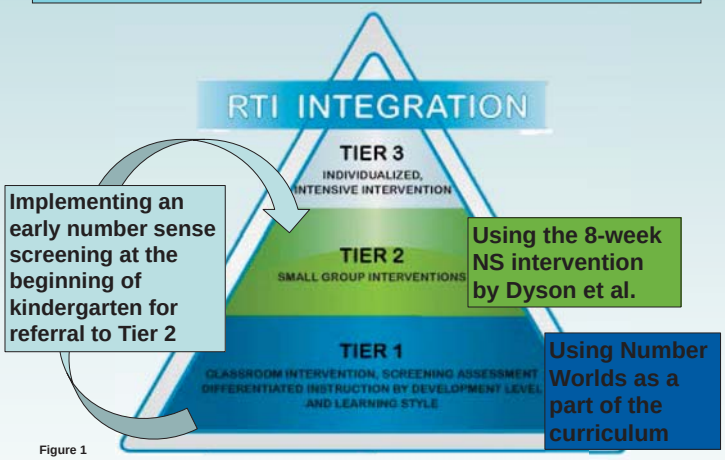

Figure 1

Figure 1 depicts how an early NS screening at the beginning of kindergarten could be used to refer students to Tier 2 of an RTI model. Several authors have proposed screening tools for NS and some have designed intervention programs that could be implemented after identification by the screening. There is no common definition of NS and therefore the screening tools and interventions vary according to their definition of number sense. Students might benefit from different interventions and one number sense intervention might not work for all students. Table 2 lists two possible screening tools and their interventions for NS in kindergarten. Figure 1 shows how the interventions could be combined in a RTI model.

The Number Knowledge Test (NKT),Okamoto & Case, 1996	Number Sense Brief (NSB), Jordan et al., 2008
• Multiple proficiency measure	• Multiple proficiency measure
• Single focus on number	• Measures number competence
• Multiple facets of numerical proficiency	• High diagnostic accuracy
• Good predictive validity	• Good predictor of future failure
• Four levels of increasing difficulty	• Tied to math curricula
• Used as assessment tool for Number Worlds program	• Combineable with a RTI delivery model
• Number Worlds provides a structured intervention program for PreK-2 (Griffin, 1995)	• 8-week NS intervention program was designed but not yet published (Dyson et al., 2013)

Table 2

Significance

The present project is intended to evoke further research in the field of number sense interventions. The discussed screening tools and interventions could be easily used and implemented by teachers. Nevertheless, more research evidence is needed in order to recommend the interventions for a broader range of implementation. The proposed combination of the two intervention programs in arrangement with a RTI model shown in figure 1, will have to be assessed in the future. The major implementation of the present project is to raise awareness of the potential of number sense for struggling kindergarten students. Teachers should become aware of mathematical interventions and shift their focus from reading to mathematics.

Selected References

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Figure 1 http://www.readyset.com/RTI.html