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Word recognition skills moderate the effectiveness of reading strategy training in Grade 2☆

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ABSTRACT

From a cognitive perspective, efficient word recognition processes are essential for the development of reading comprehension skills in primary school. In contrast, reading interventions are commonly evaluated for struggling readers as a group without assessing the influence of the students' word recognition efficiency. In this study, we followed an aptitude-treatment interaction approach to investigate the extent that the effectiveness of a reading strategy training for second graders with poor ($n = 119$) and good reading comprehension ($n = 116$) depends on the students' word reading skills. Compared with children randomly assigned to a control group, only poor readers with routinized word recognition benefited from the intervention, whereas the training was even harmful for poor readers with inefficient word recognition processes. Good comprehenders benefited from the training independently of their word reading efficiency. Hence, reading strategy interventions for poor readers should be implemented in consideration of the students' word recognition skills.

1. Introduction

Teaching children to read is considered as one of the most important objectives of primary education. However, not all children reach a satisfactory level of reading comprehension that is sufficient to meet the demands of school and society. In each individual case, the causes of poor reading comprehension may vary, because reading comprehension is based on the interplay of cognitive processes at the (sub-)lexical, the sentence, and the text level. These processes include the abilities of decoding words accurately and fluently (Perfetti, 1985), linking single word meanings to form propositional units by semantic and syntactic integration processes (Kintsch & Rawson, 2010), and connecting and enriching the text's ideas with knowledge-based inferences (Graesser, Singer, & Trabasso, 1994) to produce a coherent mental model of the text content (Van Dijk & Kintsch, 1983). Poor reading comprehension is usually associated with deficits in one or several of these processes. The cognitive processes involved in recognizing written words and assigning meaning to these words seem to play a crucial role (Perfetti & Hart, 2002), particularly in primary school children. When readers' lexical representations are less in quality or when their word recognition processes are poorly routinized, the cognitive processes on the sentence and the text level can suffer as well because of bounded working memory resources.

One major type of intervention to foster poor readers' comprehension skills in primary school is the use of reading strategy trainings (cf. meta-analysis of the National Reading Panel, NICHD, 2000). Reading strategy trainings convey knowledge about different cognitive and metacognitive strategies to foster text comprehension processes and enhance students' self-regulated handling of texts. Research indicates that strategy trainings are most effective in the upper primary grades, whereas the results for students in the lower grades are mixed. Several studies have demonstrated that reading strategy can improve the reading comprehension of poor and good readers as early as Grade 2 (e.g., Fuchs & Fuchs, 2007; Slavin, Lake, Chambers, Cheung, & Davis, 2009), especially in peer-learning settings. Other studies have found no learning gains in Grade 2, either for all students (e.g., Van Keer & Verhaeghe, 2005) or for subgroups of students (e.g., Mathes, Howard, Allen, & Fuchs, 1998).

One plausible untested explanation for the inconsistent results is that reading strategy trainings are usually evaluated with regard to their overall effectiveness instead of examining interactions with reader characteristics that might moderate their effects. Efficient word recognition skills are often discussed as prerequisites for effective reading strategy trainings (Rosenshine & Meister, 1994). Against this background, the present research followed an aptitude-treatment interaction

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approach to investigate the extent that the effectiveness of a reading strategy training in Grade 2 depends on the accuracy and efficiency of students' word recognition processes. In what follows, we will back on the assumption that word reading skills moderate the effects of a reading strategy training on reading comprehension. We begin with a discussion of word recognition processes as potential sources of individual differences in reading comprehension followed by an explanation of reading strategy trainings as a means to remediate deficits in reading skills.

1.1. Individual differences in word recognition skills

Students learning to read in an alphabetic reading system move from a phase of acquiring phonological recoding skills, which enable them to translate written words into their phonological representation, to a phase when direct access to orthographical representations is routinized (Frith, 1986). As a result, frequent words can be recognized directly and efficiently by accessing their orthographic representations without the need to recode them into a phonological representation first (Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001; Ehri, 2005). In the transparent German orthography, both phonological recoding and orthographic decoding skills develop continuously from Grades 1 through 4 with the steepest increase in Grades 1 and 2 (Richter, Isberner, Naumann, & Kutzner, 2012). High-quality and well-accessible orthographic representations allow rapid and reliable access to word meanings, which is a necessary prerequisite of reading comprehension at the sentence and text level (Perfetti, 2011; Richter, Isberner, Naumann, & Neeb, 2013).

Broad evidence exists indicating that deficits in each of the component processes of visual word recognition are linked to reading difficulties at other levels (Vellutino, Fletcher, Snowling, & Scanlon, 2004). In a cross-sectional study by Barker, Torgesen, and Wagner (1992) the increment of orthographic decoding on reading accuracy (i.e., the ability to read aloud an unknown text quickly and correctly) was found in about 20% of average skilled readers in Grade 3 after controlling for age, intelligence, and phonological recoding. In a sample of German-speaking primary students (Grades 1 through 4), Richter et al. (2013) found that the estimate of the direct effect of orthographic decoding skills on text comprehension doubled the effect of phonological recoding skills, indicating that the lexical route quickly becomes the most relevant route for visual word recognition during reading development, at least in a transparent orthography such as German. Furthermore, the effects of phonological recoding and orthographical decoding skills on comprehension were partially mediated by the quality of meaning representations and the speed of access to these representations. Similar results occurred in Grades 3 and 4 with children learning to read in Greek (Protopapas, Sideridis, Simos, & Mouzaki, 2007), which also has a transparent orthography (see Seymour, Aro, & Erskine, 2003).

A general theoretical perspective emphasizing the crucial role of word-level skills for good reading comprehension is the *lexical quality hypothesis* (Perfetti & Hart, 2001, 2002), which claims that high-quality and well-accessible lexical representations of words are the core of successful reading comprehension. The quality of a lexical representation depends on the reliability and relatedness of its constituents that specify phonology, orthography, and meaning of a word. Given that words with different meanings can have similar phonological representations (homophones, e.g., *seed* vs. *cede*) or multiple meanings can be associated with one word, representations high in quality need to be flexible to activate the meaning fitting the context. High-quality representations enable readers to recognize words and access word meanings accurately and efficiently without much cognitive effort. As a result, more cognitive resources are available for higher-order integration and inference processes at the sentence and text level (LaBerge & Samuels, 1974; Perfetti, 1985). Thus, the accuracy and fluency of word recognition are necessary prerequisites of reading with comprehension. In Richter et al. (2013), 57% of the variance in a text-based reading comprehension test was explained by efficient phonological recoding, orthographical decoding, and access to word meanings. Furthermore, many studies have demonstrated the crucial role of word recognition in reading development. For example, a current review of 28 studies on reading development from Grades 1 to 9 (Pfost, Hattie, Dörfler, & Artelt, 2013) showed that primary school students with poor word recognition skills in the lower grades exhibited only marginal gains in word recognition until the end of primary school compared to students with efficient word recognition whose reading development followed a steeper gradient.

1.2. Reading strategy trainings to foster reading comprehension in primary school

A multitude of interventions have been suggested for fostering general reading skills in primary school. One well-established family of interventions are reading strategy trainings (NICHD, 2000). The basic idea of strategy trainings is to improve reading comprehension directly by fostering the self-regulated meaning-making from texts. Ample evidence has well established that reading comprehension performance is associated with the ability to perform strategic activities such as summarizing (e.g., Dole, Duffy, Roehler, & Pearson, 1991), generating questions (e.g., McMaster et al., 2012; Yuill & Oakhill, 1988), activating prior knowledge (Cain & Oakhill, 1999), and detecting inconsistencies (comprehension monitoring, e.g., Cain, Oakhill, & Bryant, 2004). Thus, a systematic training of such cognitive and metacognitive strategies seems to be a promising method of helping children with poor reading comprehension.

According to a recent review of practical, nonremedial reading programs that are available to schools (Slavin et al., 2009), the reading comprehension of children in Grades 2 to 5 increased the most from structured programs teaching the strategies of summarizing, graphic organization, and predicting. In many of the successful reading interventions reviewed by Slavin et al. (2009), strategy instruction was combined with peer-learning techniques. These findings parallel the research by Doug and Lynn Fuchs and colleagues on peer-assisted learning strategy training (PALS, see Fuchs & Fuchs, 2007 for an overview). They showed repeatedly that reading comprehension of low and high performing students increased after a class-wide, peer-tutored instruction of the strategies of repeated reading, summarizing while reading, and prediction making compared to children in the regular reading instruction condition. The strategies of predicting and summarizing were also a part of the transactional strategy instruction examined in a study by Brown, Pressley, Van Meter, and Schuder (1996). These authors replaced the traditional reading curriculum of poor readers in Grade 2 with daily transactional strategy instruction; a complex strategy training that involves the strategies of visualizing, interpretation, and thinking aloud during reading. According to their results, the children in the treatment condition showed increased strategy use and higher comprehension scores compared to the children in the control group that received daily conventional reading instruction.

In sum, the results of extant studies support the assumption that reading strategy interventions can already have positive effects on the reading comprehension skills in Grade 2. Nevertheless, it must be noted that several studies suggest differential effects of strategies. For example, the NRP meta-analysis of 203 studies investigating reading comprehension interventions (NICHD, 2000; Chapter 4) concluded that above-average readers benefited more than below-average readers from strategy trainings. However, this finding is difficult to interpret, because it is based on studies with samples from a wide range of grade levels (Grades 3–8). Rosenshine and Meister (1994) reviewed studies on reciprocal teaching (Palinscar & Brown, 1984), a well-known dialogical instructional method that teaches the cognitive strategies of generating questions, summarizing, clarifying unknown words, and predicting. The authors concluded that the findings for Grade 3 are