



Reciprocal effects between reading comprehension and spelling[☆]

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ABSTRACT

This research aimed to identify reciprocal effects between reading comprehension and spelling in a shallow language in lower secondary school students. We drew on two samples from a German longitudinal study comprising $N = 1227$ and $N = 994$ students who were repeatedly tested at the beginning of grade 5 and grade 7. In both samples, we found reciprocal effects between reading comprehension and spelling with a greater effect from reading comprehension to spelling than vice versa. The results of our study not only add to our knowledge about the importance of proficient reading comprehension for spelling but also to the growing body of literature showing the importance of spelling knowledge for reading for understanding.

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Reading and spelling are crucial parts of literacy and, as such, essential for educational and occupational success. Thus, it is one of the most important tasks of educational systems to help students improve these skills. Furthermore, it is important to know and understand the developmental processes of these skills in order to obtain useful information for educational scientists and practitioners. However, relatively little research exists regarding the relation between reading (or text) comprehension and spelling from naturalistic studies. Moreover, the main body of research in this area concerns the English language and the extent to which the results for this rather complex orthography – in terms of orthographic depth and syllabic complexity – can be generalized to other languages remains unclear. In this context, it is interesting to note that English may even be understood as a unique language representing the exception rather than the rule as, for example, Share (2008) concludes in his comprehensive review. With this in mind, we aimed to investigate reciprocal effects of reading comprehension and spelling in German, which can be considered a shallow language. For this purpose, we drew on two relatively large samples from a longitudinal study. Each sample had two waves of data collection—one at the

beginning of grade 5 (at the age of 11) and one at the beginning of grade 7 (at the age of 13).

1. Relation between reading comprehension and spelling

Reading skills in general and spelling are closely related skills since both rely on knowledge of the alphabetic system and knowledge of how to spell particular words (Ehri, 2000). Usually, correlations between reading and spelling are quite high. Ehri (2000) summarizes several studies indicating correlations of around $r = .70$ or higher. Despite such strong correlations, there are only few theories including coherent ideas about the connected learning of reading and spelling.

One theory describing this relation in more detail has been proposed by Frith (1985). She suggested that there are causal links between reading and spelling and that this relation changes when children grow older. According to Frith, at an early stage of literacy learning, children learn the alphabetic code mainly through spelling. Then they transfer their acquired knowledge to reading. Later, however, reading is supposed to become causally dominant over spelling, that is children learn to recognize orthographic rules and patterns by reading and they also apply their knowledge from reading to spelling. Frith's idea that children acquire orthographic knowledge by reading and are able to transfer this knowledge to spelling has seldom been investigated in a proper design. One exception is the study from Davis and Bryant (2006), who found that children's word reading skill was a causal determinant of their spelling skills. One important implication from this theory and related research is that an effective strategy for learning orthography is to ensure that children have appropriate learning opportunities through reading practice.

This idea is somewhat in line with the natural learning approach which proposes that spelling proficiency can be acquired in a manner similar to naturally learning to speak (Krashen, 1989). Thus, to a certain

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extent, spelling can be acquired incidentally in a literacy rich environment where reading and writing for an intended purpose function like indirect instruction. Even though there are good reasons to assume that relying entirely on natural learning for spelling development is not sufficient (Graham, 2000), reading is still supposed to be an important source for learning to spell.

Thereby, for older students, reading comprehension becomes the more relevant reading skill in school. There are good reasons to also expect a correlation between this particular reading skill and spelling. Following Frith (1985), older students should learn orthography by reading texts so that they get used to spelling rules and patterns by being exposed to larger amounts of written words. Indeed, varying reading experience goes along with varying opportunities for learning to spell words (Burt & Fury, 2000). This assumption is indirectly supported by studies reporting strong correlations between print exposure or reading amount and reading comprehension (Cunningham & Stanovich, 1997; Mol & Bus, 2011) and studies reporting strong correlations between print exposure and spelling (Stanovich & Cunningham, 1992). Thus, reading amount might serve as an important vehicle for spelling development (see Graham, 2000 for a detailed discussion of this hypothesis); even more so for older children receiving smaller amounts of explicit spelling instruction.

Spelling may also serve as a vehicle for reading since the two abilities depend on a single orthographic lexicon (see however, Burt & Tate, 2002 for a discussion of single- vs. dual lexicon hypotheses). Thereby, spelling as the more difficult task requires a more precise lexical representation while reading comprehension may succeed even with incomplete or wrong representations. These higher requirements of spelling may lead to more complete word representations than those learned through reading and, thus, proficient spelling should lead to orthographic representations that facilitate reading comprehension. Similarly, Share argues in his self-teaching hypothesis (Shahar-Yames & Share, 2008; Share, 1995) that both translating from grapheme to phoneme in reading and from phoneme to grapheme in spelling work as a self-teaching function.

Empirical evidence for a reciprocal relationship between reading comprehension and spelling is somewhat equivocal. For example, Abbott, Berninger, and Fayol (2010) recently tested longitudinal reciprocal effects between reading comprehension and spelling in the context of a larger path model, also including word reading and written composition. In their full model, the relation between reading comprehension and spelling failed to reach significance. However, zero-order correlations between reading comprehension and spelling were substantial across and within time. Other studies investigating the relation between reading comprehension and spelling also found strong concurrent correlations between the two skills across different grades (Berninger, Abbott, Abbott, Graham, & Richards, 2002; Mehta, Foorman, Branum-Martin, & Taylor, 2005), but did not investigate longitudinal relations. More recently, Desimoni, Scalisi, and Orsolini (2012) tested the longitudinal relation between reading comprehension and spelling errors. They found significant concurrent and longitudinal zero-order correlations between the two measures. In their multiple regressions they failed to identify a significant longitudinal relation when also controlling for reading errors and reading speed. However, they still reported spelling to be significantly related to reading comprehension when controlling for age, reading speed, and reading errors when tested concurrently. A rigorous test of a reciprocal relationship was not conducted. Finally, drawing on an impressive sample size of nearly 900,000 students from grades 3 to 12, Foorman and Petscher (2010) found that lower levels of spelling ability at classroom level were related to lower levels in reading comprehension within each grade.

2. The present investigation

There has been some research investigating the correlations between reading and spelling; much work stems from laboratory

experimental studies (and many of them drew on adult samples such as university students), which of course is a strong design when you are interested in the processes underlying this relationship. However, these studies provide less information when you are interested in the relation between reading and spelling in a more naturalistic setting like school. Moreover, previous research dealing with this relationship mainly drew on English language samples and findings from this research may not be generalizable to more regular orthographies such as German (e.g., Aro & Wimmer, 2003; Seymour, Aro, & Erskine, 2003). The purpose of the present study was to investigate reciprocal effects between spelling and reading comprehension by drawing on a prospective design in two relatively large samples of German students whose development could be considered normal. Moreover, we focused on a naturalistic setting in school, applying tests that are relatively close to requirements at the beginning of secondary school (at the age of 11 years). At this age, reading comprehension of whole texts becomes an important goal of schooling in contrast to elementary school when teaching mainly focuses on more basic reading skills.

We expected to find reciprocal effects between reading comprehension and spelling for two reasons, with the effect from reading comprehension to spelling being larger than the reverse effect. First, reading is supposed to be the major vehicle for learning about spelling for older children (e.g., Frith, 1985). Second, German has a more regular grapheme–phoneme than phoneme–grapheme allocation (e.g., Aro & Wimmer, 2003) so that there are phonological units with ambiguous orthographic solutions from which only one, however, is correct. Following Wimmer and Landerl (1997) and Caravolas (2004), in such orthographies, spelling development may benefit from reading experiences, since grapheme–phoneme encoding and phoneme awareness is enhanced by reading experiences. This in turn is supposed to be beneficial for spelling acquisition. According to Desimoni et al. (2012), reciprocal relations between reading and spelling differ depending on the direction of orthographic regularity. For high levels of grapheme–phoneme and phoneme–grapheme regularity, predictions from reading to spelling should be nearly symmetrical to the reverse predictions. In contrast, in languages with a highly consistent grapheme–phoneme but lower phoneme–grapheme regularity, reading should be a stronger predictor for spelling than spelling for reading. Support for the first assumption has been presented by Babayiğit and Stainthorp (2011) who found quite symmetrical relations between reading and spelling in Turkish orthography, which is characterized by both types of regularity. For the second assumption, Desimoni et al. (2012) found that in Italian orthography reading errors predicted later spelling errors whereas the relation between previous spelling errors and later reading errors did not yield significance.

In addition to reading comprehension and spelling, we controlled for several background characteristics. First, we accounted for school track since in Germany, one core characteristic of the secondary school context is explicit between-school tracking. At the end of elementary school, based on their previous achievement, students are assigned to different types of secondary schools that either aim to prepare students for university (academic tracks) or for a vocational apprenticeship (non-academic tracks). A detailed analysis of tracking and its possible effects is far beyond the scope of this article but previous research suggests that school track might affect students' achievement development, even though language skills might be less affected than other skills such as mathematics (see Retelsdorf, Becker, Köller, & Möller, 2012 for a recent study). However, it seems necessary to control for possible confounding effects of school track when researching achievement development in German secondary schools. Second, general cognitive abilities have appeared to be a significant predictor of reading comprehension and its growth (Retelsdorf, Köller, & Möller, 2011; Vanderwood, McGrew, Flanagan, & Keith, 2002). Research on the correlation between cognitive abilities and spelling, however, is scarce and findings are somewhat equivocal. Rindermann, Michou, and Thompson (2011) found intelligence to be a strong predictor of a

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