# The benefit of retrieval practice over elaborative restudy in primary school vocabulary learning

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## ARTICLE INFO

## ABSTRACT

The testing effect is the phenomenon that retrieval practice of learning material after studying enhances long-term retention more than restudying. We examined retrieval practice in primary school vocabulary learning in two experiments. Nine-year-old children studied word definitions and completed exercises according to three learning conditions: pure restudy, elaborative restudy or retrieval practice. Children in the pure restudy condition reread and partly copied the definitions. In the elaborative restudy condition children reread the definitions and connected semantically related words to the target words. Children in the retrieval practice condition recalled the words based on their definitions. Overall, on the fill-in-the-blank test after one week children in the retrieval practice condition outperformed children in the other conditions, but on the multiple-choice test there were no differences. Retrieval practice may be effective for primary school vocabulary learning, but there is uncertainty about the practical value and the magnitude of the retrieval practice effect.

"Words are the tools we use to access our background knowledge, express ideas, and learn new concepts. The words children know will determine how well they can comprehend texts" (Stahl & Nagy, 2006, p. 4). Because words are so important, a considerable amount of time within the primary school curriculum is spent on teaching children vocabulary. A large variety of commercial vocabulary teaching programs have been developed in the last decades to support this considerable teaching endeavor, but many of these programs turned out to be unsuccessful (e.g., Blachowicz, Fisher, Ogle, & Watts-Taffe, 2006). It is therefore important to investigate whether strategies exist that can effectively augment vocabulary learning. Fundamental cognitive psychological research points at possible candidate strategies, but for many of these strategies the question is whether they generalize to classroom practice (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013). In this article, we will investigate one strategy that holds considerable promise for classroom application, namely the *testing effect* recently often relabeled as the *retrieval practice effect*, in the context of real-life primary school vocabulary learning.

When students engage in retrieval practice after an initial study phase, performance on a long-term memory test is better than when they study the same material twice (for a review, see Roediger & Karpicke, 2006). The *testing effect* or *retrieval practice effect* appears to be very robust. It has been observed in studies using word lists (e.g., Tulving, 1967; Wheeler, Ewers, & Buonanno, 2003), word pairs (e.g., De Jonge & Tabbers, 2013), or foreign vocabulary pairs as study material (e.g., Carpenter, Pashler, & Vul, 2006; Carpenter, Pashler, Wixted, & Vul, 2008; Carrier & Pashler, 1992; Karpicke & Roediger, 2008; Pashler, Cepeda, Wixted, & Rohrer, 2005; Toppino & Cohen, 2009). Furthermore, the retrieval practice effect has been replicated in studies in which people had to learn uncommon or infrequent words from their own language (e.g., Cull, 2000; Karpicke & Smith, 2012). Also, a few studies have reported a benefit of retrieval practice over restudy with primary school children (e.g., Bouwmeester & Verkoeijen, 2011b; Fritz, Morris, Nolan, & Singleton, 2007; Marsh, Fazio, & Goswick, 2012; Rohrer, Taylor, & Sholar, 2010).

However, to the best of our knowledge, only two studies have investigated retrieval practice in primary school vocabulary

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learning. One study demonstrated that – compared to self-study – learning of definition-word pairs in sixth and seventh grade children was enhanced by using a computer program in which retrieval practice was included (Metcalfe, Kornell, & Son, 2007). In another study third graders practiced twenty words and their synonyms (Goossens, Camp, Verkoeijen, & Tabbers, 2014). On the final cued-recall test after one week, word pairs learned by retrieval practice were recalled better than word pairs learned by restudy (47.0% versus 38.7%, respectively), which suggests that retrieval practice may improve vocabulary learning in children.

In the studies of Metcalfe et al. (2007) and Goossens et al. (2014) children learned word pairs in isolation. Yet, this is uncommon in classroom practice, which is characterized by children learning new words and their definitions in a meaningful context (e.g., Fuchs et al., 2003; Janssen & Van Ooijen, 2012; Van de Gein, Van de Guchte, & Kouwenberg, 2008). In the present study, we addressed this problem by examining whether retrieval practice benefits primary school vocabulary learning under conditions that mimic real-life vocabulary teaching more than the conditions in the studies of Metcalfe et al. (2007) and Goossens et al. (2014). One important feature of real-life vocabulary teaching is that children get acquainted with new words through a separate introductory learning session, which helps children focus on the word forms and word meanings. In several learning sessions after this initial learning session, children will practice the new words again. A second important feature of real-life vocabulary teaching is that repeated practice through 'pure restudy' (i.e., the exact repetition of words and their definitions) hardly – if ever – occurs. Instead, vocabulary lessons are characterized by repeated practice with new to-be-learned words in various meaningful exercises (e.g., Blachowicz et al., 2006; Fuchs et al., 2003; Janssen & Van Ooijen, 2012; Van de Gein et al., 2008). This more elaborative form of restudy is likely to lead to richer word representations than pure restudy. Indeed, previous research on vocabulary learning has shown that repetition in different contexts led to better memory for word meanings than repetition in a single context (e.g., Anderson & Reder, 1979; Bolger, Balass, Landen, & Perfetti, 2008; Carey, 1978; Coomber, Ramstad, & Sheets, 1986). Thus, to be of added value for classroom practice, retrieval practice should be more effective than elaborative restudy. Interestingly, Karpicke and Smith (2012) recently found that adults learning foreign vocabulary under conditions of retrieval practice had better long-term retention than under conditions of imagery or verbal elaboration, but whether this finding generalizes to vocabulary learning in the classroom is still an open question.

In the present study, we examined the effect of retrieval practice in primary school vocabulary learning in two experiments that were almost direct replications of each other. In each of the experiments, we incorporated the aforementioned features of real-life-vocabulary teaching. That is, all children received an introductory lesson before practice, and retrieval practice was not only compared to 'pure restudy', but also to 'elaborative restudy' using meaningful exercises based on textbook examples. In each experiment, children took a fill-in-the-blank test (in which they had to fill in the right word for a given definition), and a multiple-choice test (in which they had to choose the right word for a given context sentence) one week after the final learning session. The fill-in-the-blank test was comparable to the final tests used in earlier studies on retrieval practice (e.g., Karpicke & Smith, 2012), and was always administered first. We added the multiple-choice test for exploratory reasons, because this type of test is used very often in classroom settings. Based on earlier findings (Goossens et al., 2014; Karpicke & Smith, 2012), we hypothesized that retrieval practice would benefit vocabulary learning in the classroom compared to pure restudy and to elaborative restudy.

# 1. Experiment 1

## 1.1. Method

### 1.1.1. Participants and design

One hundred forty seven nine-year-old children were recruited from six different classes of two primary schools. The children were from the Dutch Grade 5, which is equivalent to US Grade 3. Nine children were not given permission by their parents to participate, twelve were not able to participate during both learning sessions of the experiment, and four indicated they had difficulties understanding the instructions and their data were therefore excluded. This resulted in a sample of 122 participants (65 boys, 57 girls) with a mean age of 9.18 years (range 7.84–10.60, SD = 0.42). The children knew they participated in an experiment and their parents had given informed consent.

In this experiment, learning condition (pure restudy, elaborative restudy, and retrieval practice) was manipulated between subjects. From the 122 children that participated, 41 children were in the pure restudy condition, 42 children in the elaborative restudy condition and 39 children in the retrieval practice condition. The dependent variables were cued recall as measured by a fill-in-the-blank test and recognition as measured by a multiple-choice test, both administered one week after the learning sessions.

### 1.1.2. Materials

The vocabulary words were selected from existing learning materials of the Dutch Grade 6 (Fuchs et al., 2003). The original learning material consisted of two stories that contained nine and eight target words. We excluded two words to have a final selection of fifteen words. See Table 1 for the Dutch words and their English translations. The median word frequency based on the Dutch Measure of Lexical Richness for primary school materials (Schrooten & Vermeer, 1994) was 3 (range 1–81), which is rather low.

*1.1.2.1. Introduction and exercises for the first learning session.* The target words were introduced to the children by a PowerPoint presentation and a booklet with exercises that focused on the definition and the word form. In the presentation, the fifteen words were presented each with a picture and a definition (e.g., *A pile in the garden with vegetable, fruit and garden waste, is called a compost pile.*). The booklet contained a list of the words and their definitions and two exercises. In the first exercise, children were presented with three lists of five target words and five definitions, and for each list they were instructed to connect the correct definitions with the correct target words by drawing a line. In the second exercise, children received each definition with a consonants-only cue, and they

**Table 1**
Dutch words and their English translations.

| Dutch word | English translation |
| --- | --- |
| composthoop | compost pile |
| kringloop | recycling |
| kunstmest | artificial manure |
| waterdamp | water vapor |
| milieuvervuiling | pollution |
| milieuvriendelijk | environment friendly |
| smeltwater | meltwater |
| aluminium | aluminum |
| cement | cement |
| centrale | power station |
| dynamiet | dynamite |
| graniet | granite |
| ijzererts | iron ore |
| rots | rock |
| schacht | shank |

*Note.* The English translations can deviate from the original Dutch meaning.