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## The effect of unsuccessful retrieval on children's subsequent learning



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### ABSTRACT

It is well known that successful retrieval enhances subsequent adults' learning by promoting long-term retention. Recent research has also found benefits from unsuccessful retrieval, but the evidence is not as clear-cut when the participants are children. In this study, we employed a methodology based on guessing—the weak associate paradigm—to test whether children can learn from generated errors or whether errors are harmful for learning. We tested second- and third-grade children in Experiment 1 and tested preschool and kindergarten children in Experiment 2. With slight differences in the method, in both experiments children heard the experimenter saying one word (cue) and were asked to guess an associate word (guess condition) or to listen to the correspondent target-associated word (study condition), followed by corrective feedback in both conditions. At the end of the guessing phase, the children undertook a cued-recall task in which they were presented with each cue and were asked to say the corrected target. Together, the results showed that older children—those in kindergarten and early elementary school—benefited from unsuccessful retrieval. Older children showed more correct responses and fewer errors in the guess condition. In contrast, preschoolers produced similar levels of correct and error responses in the two conditions. In conclusion, generating errors seems to be beneficial for future learning of children older than 5 years.

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## Introduction

Can we learn from errors? Recent research with adults has shown the benefit of making errors for learning (for a review, see [Metcalfe, 2017](#)). However, little is known about how generating errors can affect children's learning. This topic has importance for informing educational practice. Educators may be reluctant to ask children to guess before learning the correct information for fear that their errors would persist and be harmful for future learning. Our study aimed to give an answer to this question and contribute to the debate of whether generating errors is beneficial or detrimental for children's learning.

### *Effects of successful retrieval on learning in adults and children*

Research conducted throughout the last century (e.g., [Gates, 1917](#); [Spitzer, 1939](#); [Tulving, 1967](#)) demonstrated that testing plays a more prominent role in learning than simply being a device to assess information. More recently, a revival of interest in this topic replicated and extended previous findings about the benefits of testing for learning. There is now a large body of research showing that retrieval, in the form of tests, enhances learning. For example, [Roediger and Karpicke \(2006\)](#) compared testing previous learning material (retrieval practice) with restudying the information and found that retrieval had a greater benefit for future learning than restudy. This finding—that testing increases long-term retention—has been called the *testing effect* (e.g., [Roediger & Karpicke, 2006](#)).

The testing effect has been consistently observed with high school, middle school (e.g., [Carpenter, Pashler, & Cepeda, 2009](#); [McDaniel, Agarwal, Huelser, McDermott, & Roediger, 2011](#)), and elementary school children (e.g., [Aslan & Bauml, 2015](#); [Bouwmeester & Verkoeijen, 2011](#); [Goossens, Camp, Verkoeijen, & Tabbers, 2014](#); [Karpicke, Blunt, & Smith, 2016](#); [Lipko-Speed, Dunlosky, & Rawson, 2014](#); [Lipowski, Pyc, Dunlosky, & Rawson, 2014](#); [Rohrer, Taylor, & Sholar, 2010](#)). For example, [Lipowski et al. \(2014\)](#) demonstrated the testing effect with 7- and 9-year-old children and found a similar magnitude of the effect between these two age groups. Other authors found that retrieval practice improved vocabulary learning in children aged 8–11 years ([Goossens et al., 2014](#)) and helped fifth graders to learn key concepts in science ([Lipko-Speed et al., 2014](#)).

The results from the few published studies with younger children are mixed, with one study finding preschoolers' benefit from testing on cued recall ([Fritz, Morris, Nolan, & Singleton, 2007](#)) but another showing testing effects only for children above first grade, with younger children not benefiting from it ([Gates, 1917](#)).

### *Is it possible to learn from errors?*

Research about the effect of retrieval on subsequent memory has focused on successful retrieval (i.e., the testing effect) and shown that previously testing information enhances its subsequent memory and diminishes the absence of response. However, much less is known about the impact of wrong answers, that is, the influence of the retrieval of commission errors on subsequent memory and, thus, on learning.

When participants first give a wrong answer followed by correct feedback, it remains unclear how that affects subsequent retrievability of the correct answers. Past research on this topic was conducted by [Skinner \(1968\)](#), who introduced a teaching procedure that was designated *errorless learning*, which involves learning without committing any errors or with as few errors as possible. Proponents of errorless learning concluded that this teaching procedure was the best method to promote long-term learning, with several studies showing that there are advantages to errorless learning in individuals with memory impairments or learning disabilities (see [Clare & Jones, 2008](#), for a review). Other researchers have concluded that errorless learning techniques are similarly effective for typical adults (e.g., [Warmington & Hitch, 2014](#)) and elementary school children (e.g., [Warmington, Hitch, & Gathercole, 2013](#)) on word learning tasks.

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