

The Testing-Effect for Retention Facts and Application of Knowledge

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The Testing-Effect for Retention Facts and Application of Knowledge.

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The Testing-Effect for Retention of Facts and Application of Knowledge

Retrieving information from memory by means of testing is an effective learning strategy for learning facts (i.e., the testing-effect). In today's educational context however, more emphasis is on deeper learning (e.g., comprehension, application). In the present experiment, it was investigated if the effect of testing transfers to deeper learning (i.e., application of principles and procedures).

Prior testing-effect studies have shown that retrieving information by means of testing is beneficial for retention of facts. Although a solid knowledge base is important for application of knowledge (i.e., *retrieval of principles and procedures*), the student should also be able successfully apply them (i.e., *the execution process*, Barnett & Ceci, 2002). Thus, for successful application, retention alone is not sufficient. Although some prior testing-effect studies have investigated the effects of testing on application of knowledge, these studies did not look into application of principles or procedures to solve a problem, but looked at the application of facts or concepts (Butler, 2010) or focused on discovering which principle was illustrated (Agarwal, McDaniel, Thomas, McDermott, Roediger, 2011).

The main purpose of the present study is to investigate if testing can enhance not only the retention of facts, but also leads to better application of principles and procedures, which is reflected in better performance on application questions. For that purpose, thirty-eight Dutch-speaking secondary school students (60% males) either repeatedly studied (SSSS) a text on probability calculations or read the text, took a test, reread the text and took the test a second time (STST).

Results

An independent sample *t*-test showed a significant difference between the two groups on proportion factual knowledge questions correct ($p < .001$). Participants in the STST group performed better on the factual knowledge questions than participants in the SSSS group.

A significant difference between the groups was also found for the application questions ($p < .05$). Participants in the STST group performed better on the application questions compared to participants in the SSSS group.

Discussion

The results show that retrieving information through testing benefits not only the retention of facts, but also the application of principles and procedures. This, in itself, is an important result as most students and teachers are of the opinion that restudying is the best learning strategy (Karpicke, Butler, & Roediger, 2008). Although testing has been shown to be beneficial for fact learning, from an educational perspective it is also important to use study strategies that stimulate deeper learning (i.e., knowledge application). Although some prior testing-effect studies have shown that testing can also benefit application and transfer of facts and concepts, the present study makes a contribution to that sparse body of literature as it looked into the application of principles and procedures to solve application questions.

One of the limitations of this study is that the items in the initial and final tests were identical, and thus nothing can be reported on the application of the acquired knowledge in slightly (i.e., near transfer) to greatly (i.e., far transfer) different problem situations. Future research should address this issue further and look into the effects of testing on far transfer of principles and procedures.

Despite this limitation, the results are still interesting from both a theoretical and an applied perspective as they show that testing can be beneficial for deeper learning. More

specifically, that a testing-effect can be found not only for factual questions but also for application questions in the mathematics domain. An important practical implication of the present study is that testing for application can benefit learning.

References

Agarwal, P. K., McDaniel, M. A., Thomas, R. C., McDermott, R. C., & Roediger, H. L., III (2011, March). *Quizzing promotes deeper acquisition in middle school science: transfer of quizzed content to summative exams*. Paper presented at the SREE Conference, Washington D.C., United States

Barnett, S. M., & Ceci, S. J. (2002). When and where do we apply what we learn? A taxonomy for far transfer. *Psychological Bulletin*, *128*, 612-637. doi: 10.1037/0033-2909.128.4.612.

Butler, A. C. (2010). Repeated testing produces superior transfer of learning relative to repeated studying. *Journal of Experimental Psychology*, *36*, 1118-1133. doi: 10.1037/a0019902.

Karpicke, J. D., Butler, A. C., & Roediger, H. L. (2009). Metacognitive strategies in learner learning: Do learners practise retrieval when they study on their own? *Memory*, *17*, 4, 471-479. doi: 10.1080/09658210802647009.