"Overlearning" Study Strategies

Definition

Overlearning involves studying material beyond a pre-determined level of mastery (criterion)—in other words, continued study after one already knows the material. Overlearning can be an effective method of studying for short-term retention (i.e., the learner has an exam that day; Driskell, Willis, & Copper, 1992; Postman, 1962). In a meta-analysis, Driskell et al. (1992) found that overlearning with a brief retention interval (~1 hour in 44 out of 51 comparisons) has been found to have a moderately large affect on subsequent test performance when compared to learning to criterion. However, *for long-term retention*, overlearning is *not* the most effective use of learner time (Callender & McDaniel, 2009; Pashler, Rohrer, Cepeda, & Carpenter, 2007; Rawson & Kintsch, 2005; Rohrer, 2009; Rohrer & Taylor, 2006; Rohrer, Taylor, Pashler, Wixted, & Cepeda, 2005).

Although overlearning appears to have short-term benefits for both cognitive and motor skills, there is some evidence that retention for physical activities over time does not decline like retention for cognitive tasks (Driskell et al., 1992). For example, reserve soldiers, who were trained in procedural skills to criterion (assembling and dissembling machine guns without error at least once) and then overtrained by 100% in the same session (completing the task the same number of times it took to master it the first time), retained those skills after 8 weeks and outperformed soldiers who trained only to criterion (one perfect assembly/disassembly) and then had a refresher training 4 weeks later (Schendel & Hagman, 1982).

Examples of Commonly-used Overlearning Study Strategies

Rereading, or reading material more than once, is a study strategy commonly reported to be used by students (Amlund, Kardash, & Kulhavy, 1986; Goetz & Palmer, 1984; Karpicke, Butler, Roediger, 2009); yet, rereading has not been found to be the best study strategy for learning outcomes (Callendar & McDaniel, 2009, Griswold, Overson, & Benassi, 2017; Weinstein, McDermott, & Roediger, 2010).). Rereading primarily shows immediate (versus delayed) testing advantages (Fritz, Morris, Bjork, Gelman, & Wickens, 2000); however, when there is a delay between massed rereading (rereading material during the same session) and the testing situation, massed rereading is a less effective study strategy than distributed rereading (Rawson & Kintsch, 2005). In summary, exam performance is better when the learner spaces rereading sessions (e.g., rereading after a delay of a day), rather than rereading in one massed study session.

Massing occurs when students concentrate all study events into a single session. Students engage in massed practice, for example, when, after having mastered a particular mathematics problem, they repeat their practice by solving several simillarily-related problems. In one study, students first learned how to compute a particular type of math problem.

They then practiced computing 10 similar math problems (Rohrer & Taylor, 2006). Half of the students computed 10 questions in one sitting (massers) and the other half computed the same 10 problems but distributed their practice such that they computed 5 problems in one sitting, and then the other 5 one week later (spacers). Students took a final test either one week after the final practice session or at a four-week delay. One week test results did not differ for massers and spacers, however results for the delayed testing did differ such that the spacers demonstrated less forgetting and performed significantly better than the massers. In another study of massing versus spacing using flashcards, Kornell (2009) found that students performed better on a final test for those who studied the same items using flashcards over four days compared to those who massed the flashcard studying in one event – even though the number of times all students reviewed each card was the same.

Educational Implications

Encourage active learning strategies such as generation, self-quizzing, or answering instructor-provided question sets, can be more beneficial than rereading. (Refer to CEITL's Cognition Toolbox.)

When reading text, the 3R strategy (Read-Recite-Review; see McDaniel, Howard, & Einstein, 2009), might be more a more beneficial than rereading for efficiency and long-term retention. Using the 3R strategy, the learner first reads the text, then puts the text aside to recite all that he or she can recall from what was read, and then finally reads the text again.

Encourage students to spread their study over time, that is, over two or more sessions (distributed practice), as opposed to studying in one massed session (Carpenter, 2014; Carpenter & DeLosh, 2005; Rohrer et al., 2005; Rohrer, 2009; Rohrer & Taylor, 2006. Consider incorporating distributed practice of problems into course design for improved long-term retention of material (reduce overlearning) (Rohrer & Taylor, 2006). Distributed practice can include providing a set of problems in which there is one type of solution alternating with problems of another type of solution.

Bibliography

Amlund, J. T., Kardash, C. A. M., & Kulhavy, R. W. (1986). Repetitive reading and recall of expository text. *Reading Research Quarterly, 21,* 49–58.

Callender, A. A., & McDaniel, M. A. (2009). The limited benefits of rereading educational texts. *Contemporary Educational Psychology, 34*, 30-41. doi:10.1016/j.cedpsych.2008.07.001

Carpenter, S. K. (2014). Spacing and Interleaving of Study Practice. In V. A. Benassi, C. E. Overson, & C. M. Hakala (Eds.). Applying science of learning in education: Infusing psychological science into the curriculum. Retrieved from the Society for the Teaching of Psychology web site: http://teachpsych.org/ebooks/asle2014/index.php

Carpenter, S. K., & DeLosh, E. L. (2005). Application of the testing and spacing

effects to name learning. *Applied Cognitive Psychology, 19*, 619-636. doi: 10.1002/acp.1101

Driskell, J. E., Willis, R. P., & Copper (1992). Effect of overlearning on retention. *Journal of Applied Psychology, 77* (5), 615-622.

Fritz, C. O., Morris, P. E., Bjork, R. A., Gelman, R., & Wickens, T. D. (2000). When further learning fails: Stability and change following repeated presentation of text. *British Journal of Psychology, 91*, 493–511.

Goetz, E. T., & Palmer, D. J. (1991). The role of students' perceptions of study strategy and personal attributes in strategy use. *Reading Psychology, 12*, 199–217.

Griswold, L. A., Overson, C. E., & Benassi, V. A. (2017). Embedding Questions During Online Lecture Capture to Promote Learning and Transfer of Knowledge. *The American Journal Of Occupational Therapy: Official Publication Of The American Occupational Therapy Association*, *71*(3), 7103230010p1-7103230010p7. doi:10.5014/ajot.2017.023374

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

McDaniel, M. A., Howard, D. C., & Einstein, G. O. (2009). The Read-Recite-Review study strategy: Effective and portable. Psychological Science, 20(4), 516-522.

Pashler, H., Rohrer, D., Cepeda, N. J., & Carpenter, S. K. (2007). Enhancing learning and retarding forgetting: Choices and consequences. *Psychonomic Bulletin & Review, 14* (2), 187-193.

Postman, L. (1962). Retention as a function of degree of overlearning. *Science, 135*, 666-667.

Rawson, K. A., & Kintsch, W. (2005). Rereading effects depend on time of test. *Journal of Educational Psychology, 97*(1), 70-80. doi: 10.1037/0022-0663.97.1.70

Rohrer, D. (2009). Avoidance of overlearning characterizes the spacing effect. *European Journal of Cognitive Psychology, 21* (7), 1001-1012. doi: 10.1080/09541440802425954

Rohrer, D., & Taylor, K. (2006). Effects of overlearning and distributed practice on the retention of mathematics knowledge. *Applied Cognitive Psychology, 20*, 1209-1224. doi: 10.1002/acp.1266

Rohrer, D., Taylor, K., Pashler, H., Wixted, J. T., & Cepeda, N. J. (2005). The effect of overlearning on long-term retention. *Applied Cognitive Psychology, 19*, 361-374. doi:10.1002/acp.1083

Schendel, J. D. & Hagman, J. D. (1982). On sustaining procedural skills over a prolonged retention interval. *Journal of Applied Psychology, 67*(5), 605-610.

Weinstein, Y., McDermott, K. B., & Roediger, H. L., III. (2010). A comparison of study strategies for passages: Rereading, answering questions, and generating questions. *Journal of Experimental Psychology: Applied, 16* (3), 308-316. doi: 10.1037/a0020992