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Does Covert Retrieval Benefit Learning of Key-Term Definitions?

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Even though retrieval practice typically has a robust, positive influence on memory, response format (overt vs. covert retrieval) may moderate its effect when students learn complex material. Overt retrieval is likely to promote exhaustive retrieval, whereas covert retrieval may not be exhaustive for familiar key terms. In two experiments, students were instructed to study key-term definitions and were asked to practice retrieval overtly, to practice retrieval covertly, or to restudy the definitions. Students also made metacognitive judgments. A final criterion test was administered two days later. Students' final recall was greater after overt retrieval practice than after covert retrieval practice or restudy, with a continuously cumulating meta-analysis establishing the effect as moderate in size (pooled $d = 0.43$). Thus, response format does matter for learning definitions of key terms, supporting the recommendation that students use overt retrieval when using retrieval practice as a strategy to learn complex materials.

Keywords: Covert retrieval, Retrieval practice, Key-term definitions, Monitoring of learning, Metacognition

General Audience Summary

One strategy that typically improves students' memory is to test themselves on information that they need to learn. Students may do so by speaking their answers out loud, by writing or typing their answers, or by mentally answering each question. For instance, a student studying in a library may mentally answer questions to avoid distracting others. By contrast, a student studying with a group may offer answers out loud as a part of the group discussion. Our interest was to evaluate whether these different types of responses (typed recall vs. mental recall) influence how effective self-testing is for improving students' memory when

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they learn key-term definitions. In two experiments, students studied key terms (e.g., *self-serving bias*) and the corresponding definition for each (*When explaining one's own behavior it is the tendency to attribute good behaviors to one's disposition and to attribute bad behaviors to the situation*). Students then restudied the key terms and definitions, or tested themselves on them. Students who tested themselves typed the definition for each term, or were instructed to mentally recall the definition for each. Students in all three groups also made judgments about their memory and returned two days later to complete a final memory test. In a first experiment, students' memory on the final test was greater after typing the recalled definitions than after mentally recalling the definitions, or after restudying the definitions. In a second experiment, the same patterns were evident, although the memory benefit after typing the recalled definitions was smaller. These results suggest that *how* students test themselves is important when they are learning conceptual definitions. Thus, our recommendation is that students type out recalled answers during self-testing when they are learning relatively complex materials.

Retrieval practice typically benefits learning and memory, and its benefits have been referred to as *test-enhanced learning* (for a review see Rowland, 2014). This robust benefit has been demonstrated across a wide range of materials, learners, outcomes, and settings (for reviews, see Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013; Roediger & Butler, 2011). Although retrieval practice has a robust effect on people's retention, some factors moderate its benefits (e.g., Kornell, Hays, & Bjork, 2009; Roediger & Karpicke, 2006). Thus, fully understanding the benefits of retrieval practice will involve discovering its moderators, which is the main goal of the present research. In particular, we evaluated whether the benefits of retrieval practice are moderated by response format (i.e., overt versus covert responding). Investigating response format is important because students are likely to adopt different formats in different contexts. For instance, a student using retrieval practice in a library may covertly retrieve answers (i.e., mental retrieval) to avoid distracting others. By contrast, a student studying with a group may overtly retrieve answers as a part of the group discussion. As such, it is critical to estimate the effectiveness of each response format, which leads us to the key question of this research: Does response format influence the magnitude of final recall performance when students attempt to learn key-term definitions?

Previous research suggests that overt and covert retrieval have similar effects on learning. Putnam and Roediger (2013) explored the influence of response format during retrieval practice when students learned paired associates (e.g., *airplane-trip*). After initial study, participants were instructed to overtly practice retrieving the target for some pairs, to covertly practice retrieving the target for some pairs, and to restudy some word pairs. On a final cued-recall test 2 days later, participants were shown each cue word (e.g., *airplane-?*) and were asked to type the target (i.e., *trip*). Performance on the final recall test was superior after retrieval practice (overt or covert) as compared to no retrieval practice (i.e., restudied word pairs), and it was similar for overt and covert practice. Smith, Roediger, and Karpicke (2013) analyzed the results from 10 experiments comparing the effect of overt (vs. covert) retrieval on memory, and their analysis yielded an effect size close to zero ($d = -.0027$). By contrast, comparing retrieval practice (either covert or overt) to no retrieval practice yielded a large effect size ($d = 1.1$) in favor of retrieval practice.

In other studies, however, response format for retrieval practice has recently been shown to have a minor influence on paired associate recall. Jönsson, Kubrik, Sundqvist, Todorov, and Jonsson (2014) had participants study Swahili–Swedish translations, and participants were instructed to practice overt retrieval or covert retrieval, or to restudy the pairs in preparation for immediate or delayed tests. Although overt retrieval practice was superior to covert retrieval practice in one experiment using a within-participant design, it was a small effect ($d = 0.21$ for a long retention interval). It was also not robust; overt retrieval did not statistically differ from covert retrieval in another experiment (or after a short retention interval). Thus, across all the available studies, retrieval practice appears to be effective with covert responding, at least with paired associates.

Response format for retrieval practice may not matter much for learning paired associates because presenting the cue alone triggers a retrieval attempt (e.g., Craik, Govoni, Naveh-Benjamin, & Anderson, 1996); so, regardless of whether responses are covert or overt, people are expected to initiate retrieval of the single-word response. The situation may be different for longer and more complicated material. In such cases, covert retrieval may not benefit recall as much as overt retrieval because students may not undergo exhaustive retrieval. For example, consider students learning key-term definitions, such as the definition of *confirmation bias* (answer: *The tendency to only seek out or attend to information that confirms one's belief and to ignore counterevidence*). For these materials, the retrieval demands are presumably higher because students need to retrieve multiple units of information to accurately represent the response. And, if students feel they are familiar with the concept, this familiarity may short-circuit a retrieval attempt (e.g., by responding, "Oh, I already know that one"). In the case of unfamiliar terms, students may not even try to retrieve the answer. In either case, if students do not attempt to exhaustively retrieve the definition when they covertly practice retrieval, then no benefit would be expected. By contrast, during overt practice, students may be more likely to fully retrieve the definition simply because they are being asked to type (or say aloud) as much of it as possible. Thus, when compared with covert retrieval

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