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Asking students questions before they learn something has been shown to enhance memory for that information. Studies demonstrating this *prequestion effect* in reading tasks have shown that such prequestions may not enhance—and could even impair—learning of information that was not prequestioned, possibly due to learners' tendencies to selectively process the prequestioned information at the expense of non-prequestioned information. The current study explored the effects of prequestions on learning from videos, where such a selective processing strategy would be less likely to occur. Participants viewed an educational video and either answered prequestions prior to viewing each of three segments (Prequestion Group) or viewed the same video without answering prequestions (Control Group). A later test revealed a significant advantage for the Prequestion Group over the Control Group, and this pertained to both prequestioned and non-prequestioned information. Thus, prequestions appear to confer both specific and general benefits on video-based learning.

General Audience Summary

Asking students questions about what they are learning can significantly enhance their memory for that information. One specific way to do this is through *prequestions*—posing questions to students about to-be-learned material before they have learned it. Research has shown that prequestions prior to a reading assignment can enhance the amount of information that students remember from that reading. Unfortunately however, there is some evidence that prequestions may impair memory for sections of the reading that were not relevant to the prequestions, possibly because students attend more to sections of the passage that are relevant to the prequestions and could skip sections that are not relevant. In the current study, we explored the influence of prequestions on learning from video presentations, where such a strategy would be less likely due to the fact that the content and timing of videos are not learner-paced. Students viewed a brief educational video about the history of Easter Island. Some students answered two questions prior to viewing each of three segments of the video (the Prequestion Group), and others viewed the same video but did not answer prequestions (the Control Group). On a later test over all of the information from the video, the Prequestion Group performed higher than the Control Group. The Prequestion Group had better memory than the Control Group for information that was previously prequestioned, as well as for information from the video that was not prequestioned. These results suggest that prequestions are an effective tool for enhancing learning from relatively brief video presentations, without any harmful effects on non-prequestioned information, raising the possibility that they could be adapted for educational purposes to improve learning from videos or lecture presentations.

Keywords: Prequestions, Testing, Retrieval, Learning, Memory

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One of the most effective techniques for enhancing memory is to ask students questions about what they are learning. Decades of research on the *testing effect* have shown that students learn significantly more when they answer questions about material they are trying to learn, compared to simply restudying it (for recent reviews, see Carpenter, 2012; Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013; Kornell & Vaughn, in press; Roediger & Butler, 2011; Rowland, 2014). So robust are the benefits of testing that cognitive scientists have often argued for its widespread implementation in educational settings as a straightforward and cost-effective tool for enhancing student achievement (Brown, Roediger, & McDaniel, 2014; Butler, Marsh, Slavinsky, & Baraniuk, 2014; Carpenter, 2014; Dunlosky et al., 2013; Pashler et al., 2007; Roediger & Pyc, 2012).

To date, most of what we know about the benefits of testing comes from studies in which students were tested over information after it was presented to them. We know much less about the mnemonic potential of asking students questions *before* they are presented with material to learn. Though such an approach might seem counterintuitive—how can students answer a question about material they have not yet learned?—research shows that such *prequestions* can significantly enhance students' encoding, and later memory, of the to-be-learned information. For example, Rickards (1976a) had participants read an 800-word passage about a fictitious African country Mala. The passage was organized into eight segments consisting of two paragraphs each. Some participants received a question that was relevant to the to-be-read segment prior to reading it ("How many inches of rain fall per year in southern Mala?"), whereas others read the passage without answering any questions relevant to the passage. On an immediate free-recall test over the passage, the group that received prequestions recalled significantly more than the group that read the passage without answering prequestions.

Other studies have demonstrated significant benefits of prequestions using reading tasks with slight variations in design, such as multiple-choice prequestions over the to-be-read passages followed by either a final multiple-choice test (Peeck, 1970) or a cued-recall final test (Little & Bjork, 2016, Experiment 3), or open-ended prequestions over the to-be-read passages followed by a final test containing multiple-choice questions (Bull & Dizney, 1973), fill-in-the-blank, short-answer, or cued-recall questions (Little & Bjork, 2016, Experiment 3; Pressley, Tanenbaum, McDaniel, & Wood, 1990; Richland, Kornell, & Kao, 2009; Rickards, Anderson, & McCormick, 1976), or a free-recall final test (Rickards, 1976b). In these studies, participants who received prequestions prior to reading the passages—even though explicit feedback of the correct answers was not provided at the time of the prequestions—performed better on the final test, compared to participants who read the same passages without answering prequestions first.

The benefits of prequestions have been attributed to their potential to serve as an orienting device that provides students with a preview of what they will be learning (Hannafin & Hughes, 1986; Mayer, 1984), or to the tendency for prequestions to arouse curiosity about the to-be-learned information (Berlyne, 1954, 1962; Bull & Dizney, 1973). There is also the (non-mutually-exclusive) possibility that prequestions act

as a metacognitive "reality check," serving to inoculate students from the detrimental effects of overconfidence that so often occur during learning (Bjork, Dunlosky, & Kornell, 2013; Finn & Tauber, 2015). Only by trying—and *failing*—to answer a question might students gain the explicit awareness that they do not know the content, and this might facilitate more effective encoding strategies.

Further research suggests that the benefits of prequestions may be limited, however. Namely, the learning advantage that results from prequestions is typically restricted to the information in the reading passage that was prequestioned (Bull & Dizney, 1973; Frase, 1968; Pressley et al., 1990; Richland et al., 2009). For example, in reading about the fictitious country Mala (Rickards, 1976a), answering a prequestion about the annual rainfall in southern Mala facilitated later memory for that same piece of information, but did not facilitate, relative to the control group, memory for other information about Mala that was not prequestioned, such as facts about its history, government, or social conditions.

Of greater concern is the finding that prequestions might even produce harmful effects on the learning of non-prequestioned information. In comparing a group that received prequestions versus a control group on their later memory of both prequestioned and non-prequestioned information, some studies have shown that the group receiving prequestions outperformed the control group on the prequestioned information, but actually performed *worse* than the control group on the non-prequestioned information (Peeck, 1970; Rickards, 1976a, 1976b; Sagaria & Di Vesta, 1978).

As it would seem unwise to advocate the use of a technique that has been shown to impair the learning of information under some circumstances, the educational potential of prequestions is currently uncertain. Further research is needed that can clarify the nature of these effects and when they can be expected to occur. In particular, why might prequestions produce harmful effects on later memory of non-prequestioned information? Some researchers have proposed that prequestions might encourage the selective processing of information during reading, in that participants attend more strongly to the information in the passage that is most relevant to the prequestions and attend less to (or possibly even skip altogether) information that is not relevant to the prequestions (e.g., Peeck, 1970; Pressley et al., 1990; Sagaria & Di Vesta, 1978).

Such a selective processing strategy would be easy to do while reading. Having the passage directly available and being permitted to read at their own pace, participants could decide which parts of the passage to pay more attention to and could elect to skip some parts altogether. Some support for this possibility might be gleaned from Sagaria and Di Vesta's (1978) observation that participants who received prequestions spent less overall time on the reading passage compared to participants who read the same passage but received the questions after, rather than before, reading the relevant segments.

To date, the known research on prequestions has relied heavily on reading materials as stimuli. An alternative task that has not been systematically explored in studies of prequestions is learning from presentations. When students attend a lecture

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