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There's stronger brain activity after writing on paper than on a tablet or smartphone



I've written a number of times about how reading from paper is better than reading from an electronic device (reader, tablet, computer screen, smartphone) when it comes to learning. I've done the same with respect to writing. Here's a short synopsis of a study on the latter.

A [recent study](#) of university students and recent graduates has revealed that writing on physical paper can lead to more brain activity when remembering the information an hour later. Researchers say that the unique, complex, spatial, and tactile information associated with writing by hand on physical paper is likely what leads to improved memory.

Abstract

It remains to be determined how different inputs for memory-encoding, such as the use of paper notebooks or mobile devices, affect retrieval processes. We compared three groups of participants who read dialogues on personal schedules and wrote down the scheduled appointments on a calendar using a paper notebook (Note), an electronic tablet (Tablet), or a smartphone (Phone). After the retention period for an hour including an interference task, we tested recognition memory of those appointments with visually presented questions in a retrieval task, while scanned with functional magnetic resonance imaging. We obtained three major results. First, the duration of writing down schedules was significantly shorter for the Note group than the Tablet and Phone groups, and accuracy was much higher for the Note group in easier (i.e., more straightforward) questions. Because the input methods were equated as much as possible between the Note and Tablet groups, these results indicate that the cognitive processes for the Note group were deeper and more solid. Second, brain activations for all participants during the retrieval phase were localized in the bilateral hippocampus, precuneus, visual cortices, and language-related frontal regions, confirming the involvement of verbalized memory retrieval processes for appointments. Third, activations in these regions were significantly higher for the Note group than those for the Tablet and Phone groups. These enhanced activations for the Note group could not be explained by general cognitive loads or task difficulty, because overall task performances were similar among the groups. The significant superiority in both accuracy and activations for the Note group suggested that the use of a paper notebook promoted the acquisition of rich encoding information and/or spatial information of real papers and that this information could be utilized as effective retrieval clues, leading to higher activations in these specific regions.

The authors conclude:

Our present experiments demonstrated that brain activations related to memory, visual imagery, and language during the retrieval of specific information, as well as the deeper encoding of that information, were stronger in participants using a paper notebook than in those using electronic devices. Our results suggest that the use of a paper notebook affects these higher-order brain functions, and this could have important implications for education, particularly in terms of the pros and cons of e-learning. The expanded use of mobile devices or computers could undercut the use of traditional textbooks and paper notebooks, which may in fact provide richer information from the perspective of memory encoding. Further research is needed to elucidate the actual changes in brain activation due to the long-term exposure to mobile devices.

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