A Learning Secret: Don't Take Notes with a Laptop

Students who used longhand remembered more and had a deeper understanding of the material

By Cindi May on June 3, 2014   **Véalo en español**

Credit: Mayur Kakade *Getty Images*

"More is better." From the number of gigs in a cellular data plan to the horsepower in a pickup truck, this mantra is ubiquitous in American culture. When it comes to college students, the belief that more is better may underlie their widely-held view that laptops in the classroom enhance their academic performance. Laptops do in fact allow students to do more, like engage in online activities and demonstrations, collaborate more easily on papers and projects, access information from the internet, and take more notes. Indeed, because students can type significantly faster than they can write, those who use laptops in the classroom tend to take more notes than those who write out their notes by hand. Moreover, when students take notes using laptops they tend to take notes verbatim, writing down every last word uttered by their professor.

Obviously it is advantageous to draft more complete notes that precisely capture the course content and allow for a verbatim review of the material at a later date. Only it isn't. New research by Pam Mueller and Daniel Oppenheimer demonstrates that students who write out their notes on paper actually learn more. Across three experiments, Mueller and Oppenheimer had students take notes in a classroom setting and then tested students on their memory for factual detail, their conceptual understanding of the material, and their ability to synthesize and generalize the information. Half of the students were instructed to take notes with a laptop, and the other half were instructed to write the notes out by hand. As in other studies, students who used laptops took more notes. In each study, however, those who wrote out their notes by hand had a stronger conceptual understanding and were more successful in applying and integrating the material than those who used took notes with their laptops.

What drives this paradoxical finding? Mueller and Oppenheimer postulate that taking notes by hand requires different types of cognitive processing than taking notes on a laptop, and these different processes have consequences for learning. Writing by hand is slower and more cumbersome than typing, and students cannot possibly write down every word in a lecture. Instead, they listen, digest, and summarize so that they can succinctly capture the essence of the information. Thus, taking notes by hand forces the brain to engage in some heavy "mental lifting," and these efforts foster comprehension and retention. By contrast, when typing students can easily produce a written record of the lecture without processing its meaning, as faster typing speeds allow students to transcribe a lecture word for word without devoting much thought to the content.

To evaluate this theory, Mueller and Oppenheimer assessed the content of notes taken by hand versus laptop. Their studies included hundreds of students from Princeton and UCLA, and the lecture topics ranged from bats, bread, and algorithms to faith, respiration, and economics. Content analysis of the notes consistently showed that students who used laptops had more verbatim transcription of the lecture material than those who wrote notes by hand. Moreover, high verbatim note content was associated with *lower* retention of the lecture material. It appears that students who use laptops can take notes in a fairly mindless, rote fashion, with little analysis or synthesis by the brain. This kind of shallow transcription fails to promote a meaningful understanding or application of the information.

If the source of the advantage for longhand notes derives from the conceptual processes they evoke, perhaps instructing laptop users to draft summative rather than verbatim notes will boost performance. Mueller and Oppenheimer explored this idea by warning laptop note takers against the tendency to transcribe information without thinking, and explicitly instructed them to think about the information and type notes in their own words. Despite these instructions, students using laptops showed the same level of verbatim content and were no better in synthesizing material than students who received no such warning. It is possible these direct instructions to improve the quality of laptop notes failed because it is so easy to rely on less demanding, mindless processes when typing.

It's important to note that most of the studies that have compared note taking by hand versus laptop have used immediate memory tests administered very shortly (typically less than an hour) after the learning session. In real classroom settings, however, students are often assessed days if not weeks after learning new material. Thus, although laptop users may not encode as much during the lecture and thus may be disadvantaged on immediate assessments, it seems reasonable to expect that the additional information they record will give them an advantage when reviewing material after a long delay.

Wrong again. Mueller and Oppenheimer included a study in which participants were asked to take notes by hand or by laptop, and were told they would be tested on the material in a week. When participants were given an opportunity to study with their notes before the final assessment, once again those who took longhand notes outperformed laptop participants. Because longhand notes contain students' own words and handwriting, they may serve as more effective memory cues by recreating the context (e.g., thought processes, emotions, conclusions) as well as content (e.g., individual facts) from the original learning session.

These findings hold important implications for students who use their laptops to access lecture outlines and notes that have been posted by professors before class. Because students can use these posted materials to access lecture content with a mere click, there is no need to organize, synthesize or summarize in their own words. Indeed, students may take very minimal notes or not take notes at all, and may consequently forego the opportunity to engage in the mental work that supports learning.

Beyond altering students' cognitive processes and thereby reducing learning, laptops pose other threats in the classroom. In the Mueller and Oppenheimer studies, all laptops were disconnected from the internet, thus eliminating any disruption from email, instant messaging, surfing, or other online distractions. In most typical college settings, however, internet access is available, and evidence suggests that when college students use laptops, they spend 40% of class time using applications unrelated to coursework, are more likely to fall off task, and are less satisfied with their education. In one study with law school students, nearly 90% of laptop users engaged in online activities unrelated to coursework for at least five minutes, and roughly 60% were distracted for half the class.

Technology offers innovative tools that are shaping educational experiences for students, often in positive and dynamic ways. The research by Mueller and Oppenheimer serves as a reminder, however, that even when technology allows us to do more in less time, it does not always foster learning. Learning involves more than the receipt and the regurgitation of information. If we want students to synthesize material, draw inferences, see new connections, evaluate evidence, and apply concepts in novel situations, we need to encourage the deep, effortful cognitive processes that underlie these abilities. When it comes to taking notes, students need fewer gigs, more brain power.

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