

Sometimes Books and Paper and Pencil are Better

Schools are finding that students who learn with screens (for example online textbooks on an iPad or Chromebook) are not learning as well as in the past when physical (paper) textbooks were used. The question is why

Why - 7 categories of reasons

A substantial body of research suggests students often comprehend and retain less when reading from screens than from print—especially for longer, complex texts. Researchers have explored *why*. Here are the main explanations (compactly organized):



1. Shallower processing (“screen inferiority effect”)
 - Screens encourage skimming rather than sustained reading.
 - Students tend to overestimate how well they understand digital texts.
 - Print promotes slower, more deliberate reading.
2. Reduced metacognitive calibration
 - Readers are often overconfident on screens.
 - They predict higher performance than they actually achieve.
 - This leads to less re-reading and fewer comprehension checks.
3. Physical-spatial cues
 - Paper provides tactile and spatial markers (top/bottom of page, thickness of pages read).
 - These cues help memory and mental mapping of content.
 - Screens (especially scrolling) reduce these anchors.
4. Cognitive load & distraction
 - Notifications, hyperlinks, multitasking habits increase divided attention.
 - Even the *habit* of digital multitasking lowers deep comprehension.
5. Embodied cognition (writing vs typing)
 - Handwriting improves encoding and retention.
 - Typing often leads to verbatim transcription instead of processing.
6. The “Google effect” (transactive memory)
 - Yes—research shows people remember *where to find* information rather than the information itself when they expect future access.
 - When learners believe material is always retrievable online, they invest less effort in storing it internally.
7. Reading goals & mindset
 - Screens are culturally associated with speed and entertainment.
 - Print is associated with study and seriousness, influencing cognitive posture.

Important nuance

- Differences shrink when students read carefully, avoid scrolling, and eliminate distractions.
- Technology is powerful for visualization, simulation, collaboration, and access—but deep comprehension still often benefits from print-like conditions.

Summarize Key studies behind these conclusions

Here are several *landmark* and frequently cited studies explaining the “screen inferiority” effect and related findings:

1. Mangen, Walgermo & Brønnick (2013)
 - Norwegian 10th graders read the same narrative text in print or PDF.
 - Print readers scored significantly higher on comprehension.
 - Authors suggested tactile/spatial cues in paper aid mental mapping.
2. Delgado et al. (2018) – Large Meta-Analysis (54 studies; 170,000+ participants)
 - Print reading led to better comprehension overall.
 - The gap widened for informational texts and under time pressure.
 - Students were more overconfident on screens.
3. Clinton (2019) – Meta-Analysis
 - Confirmed small but consistent advantage for print.
 - Effect strongest for expository texts.
 - Suggested scrolling disrupts spatial continuity.
4. Ackerman & Goldsmith (2011)
 - Readers studying on screens showed poorer metacognitive regulation.
 - They believed they learned more than they did.
 - Under time limits, screen performance dropped more sharply.
5. Mueller & Oppenheimer (2014) – Handwriting vs Typing
 - Students who took notes by hand performed better on conceptual questions.
 - Typists tended to transcribe verbatim.
 - Handwriting forced processing and summarizing.
6. Sparrow, Liu & Wegner (2011) – “Google Effect”
 - When participants expected information to be saved digitally, they remembered the *location* better than the content.
 - Demonstrates transactive memory reliance on technology.
7. Ophir, Nass & Wagner (2009) – Media Multitasking
 - Heavy multitaskers performed worse on attention and filtering tasks.
 - Suggests habitual screen multitasking weakens deep focus.

General conclusion:

Researchers point to shallower processing, weaker metacognition, reduced spatial cues, multitasking habits, and transactive memory reliance—not simply “screens are bad,” but differences in how the brain engages.