

***Digital Resources and
Learning –
Caveat Emptor!***

***A Short Essay – Understanding the Effectiveness
of these Curricular Resources on Student
Learning***

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April 1, 2026

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By Blaine Helwig

The world has moved into the digital realm in almost every facet of our lives. Phones, computers, finance, camera surveillance, dating, medical, autonomous vehicles, etc. The transition to digital use has been ubiquitous and amazing. Of course, the digital age has brought fantastic benefits in information and connectedness and ease. No doubt about it.

But, in public education, when it comes to the use of digital resources and student learning, have we thrown *the baby out with the bathwater*?

Everything that affects student learning in American classrooms deserves an honest look. Let's discuss it!

Mastery of content requires a transition of content or knowledge from *working memory* and *short term* to *long-term memory*. This process ***should be*** independent of content whether it is a traditional paper-pencil process or a digital medium. We require content exposure and practice. Eventually, a threshold number of repetitions is reached, and we ingrain the content into our long-term memory.



Of course, digital learning requires a medium ~ a smart phone, tablet or laptop computer, and herein lies the issue. Children are primarily learning content with the aid of a keyboard interface. They type in their response to a digital prompt.

About 15 years ago when digital programs were coming into vogue in public schools, I remember being ambivalent and leaning toward the skeptical side of these programs. As an elementary principal, I preferred to focus on the basics of the digital basics: keyboarding, word processing, and spreadsheets. In my mind, these skill sets were computer skills that are the essential tools our elementary students would need to thrive in middle and high school, college, and later on, in the work force.

Many teachers, both then and now, advocate for digital learning programs based on several key rationales. First, these tools provide students with valuable technological immersion. Second, they consistently foster high levels of student engagement. Third, these digital sessions serve as a seamless extension of core classroom activities. Finally, the 'bells and whistles' of such programs capture and maintain student interest effectively.

As an administrator, however, I remained skeptical. My primary concern was accountability: *were these digital experiences producing long-term learning?* I also viewed the time commitment of 15 minutes per session as a significant cumulative loss if the activities lacked depth. My skepticism was confirmed in 2021 while working as a consultant; after interviewing students following their digital sessions, I found that true retention was nearly non-existent. The information rarely moved beyond working or short-term memory. Ultimately, these programs seemed to function more as a break for teachers than as a meaningful cognitive exercise for students.

What is the Difference Between Keyboard Typing and Pen and Paper Writing?

A 2024 study by Norwegian neuroscientists from the Norwegian University of Science and Technology (NUNT) discovered an astonishing conclusion about digital devices and student learning. They had students type words on a keyboard versus writing the same words in print by hand with a 256-electrode studded helmet that measured brain activity. They found there was significant neural electrical connective action

during keyboard typing compared to the brain activity when the students wrote the same words with pen and paper. The researchers believe this gap exists because typing is repetitive: pressing an 'a' on the keyboard feels exactly like pressing a 'b' or a '6.' Every keystroke uses the same generic finger tap – indistinguishable from each other.

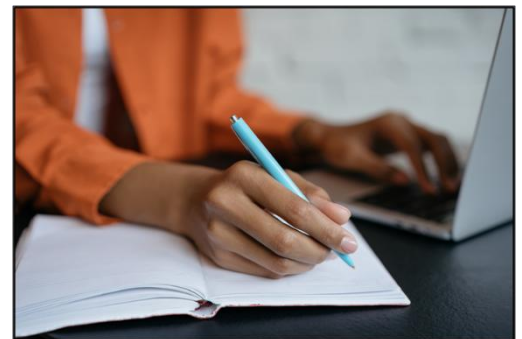


Handwriting, however, requires a unique, complex movement for every single character. Creating a 'b' is a completely different physical experience than drafting an 'f' or an 'm.' This distinct motor activity appears to be the key to successfully moving information from working and short-term memory into long-term storage.

As an educator, I've always seen the empirical proof in my classroom: students who write by hand simply retain more than those who type on a keyboard. I knew there was a clear difference in how they "impressed" the material into their minds, but I never realized the explanation was so elegantly simple until I saw this Norwegian data. It turns out the "magic" isn't just in the effort; it is in the unique physical geometry of every letter. While a keyboard treats every thought as an identical tap, a pen treats every word as a distinct physical experience.

For example, when I use the Duolingo language acquisition app, relying solely on the keypad prevents me from truly ingraining Spanish. Spelling and grammar remain housed in my short-term memory, requiring far more repetition than usual. However, if I follow my digital daily lesson by writing out words and sentences by hand, the information moves into my long-term memory almost immediately with very little effort. If I do not follow up with pen and paper, I transition through the lessons at a very slow rate since I need to constantly review the previous day's lesson. Simply put, I do not remember the content, and I am very skilled at memorization.

I have also noticed a similar pattern with daily word games like Wordle or Quartiles. Even though I have spent concentrated minutes puzzle-solving on my smart phone, I often cannot recall the winning words only fifteen minutes later. It's as if the digital interface keeps the information trapped in my working and short-term memory. Now, I imagine if I wrote the words on paper, I would remember and recall them more efficiently. Moreover, I find that if I scribble pen and paper notes during a You-Tube video, I recollect the steps outlined in the video with specificity. If I do not activate and engage during the video with physical writing, I need to rewatch the same video several times over. In short, the digital, visual phase of these programs seems to avoid the heavy lifting and active mental engagement that is required to consolidate the content into long-term memory.



Digital Learning seems to be a Mixed Bag – with Engagement being Key!

Human activity is essentially a series of experiments. In medicine, for instance, researchers test substances, from herbs to synthetic chemicals, to observe their impact on the human body. While this leads to breakthroughs like penicillin, it also carries the risk of unforeseen side effects. Public education follows the same pattern, albeit usually in a more innocuous process. Educators introduce new tools and methods in their classroom to measure their success. Basically, the shift over the last couple decades toward digital learning with iPads and computers is simply the latest phase of this ongoing trial-and-error process.

Having attended public schools in the 1960's and 70's and university in the early 80's, my educational foundation was built entirely through traditional, non-digital means. While today's elementary, middle and high school students benefit from unprecedented access to information, there is a concern that this constant digital connectivity may have a detrimental effect on both their learning and neurological development compared to the grounded, foundational approach of previous generations. However, digital engagement carries unique implications for children compared to adults, as adolescent neurological development continues throughout their primary and secondary education years.



Let's start with the worst – iPad kids. The "iPad kid" is a term describing children who consume three to six hours of digital media daily. These children may be seen in public places like restaurants where parents provide them with a screen to quiet them. This demographic is often characterized by a constant requirement for high-level stimulation and significant emotional upheaval upon the removal of the device. The neurological impact of excessive screen time is often colloquially called "brain rot." Scientific research involving CT scans suggests that children with prolonged exposure show decreased activity in certain brain regions compared to their peers. While these behavioral patterns represent a critical area of digital research, they fall outside the primary scope of this analysis. The following discussion focuses exclusively on the pedagogical implications within the school environment. Readers interested in the broader psychological effects are encouraged to consult independent research.



The classroom case of digital learning and its benefits appear to drill down to one word: *engagement*. Those digital programs that stimulate active engagement appear to be more effective. For example, if the screen allows students or children to draw or write on the screen with their finger or a stylus, the cognitive impact on the brain is stimulated. These digital programs circumvent the generic keyboard letter issue discussed earlier. Consequently, there is a higher possibility of long-term learning benefits. The other effective digital resources are the ones that are hybrid in nature. They afford a *physical* writing component during the learning engagement, turning a passive event into an active one. The benefits

of the act of writing on student learning are extolled in the white paper: *'Writing' – An Overlooked Learning Modality*. It is available for free download at the website address provided in the footer of this document.

Fundamentally, the central issue is educational content. What digital resources are truly educational in nature, and which ones are simply digital distractions? Moreover, if digital resources or games are used, is there any *accountability* on learning? Is there an 'exit ticket' that verifies student learning from a digital activity as is the case with traditional classroom activities? Basically, there must be a verifiable student work product that proves students' learning and understanding, so an educator's formative assessment provides 'next steps' in their pedagogical sequencing. If these accountability and learning issues are not addressed, an educator should seriously consider the implementation of any type of resource in their classrooms – digital or traditionally based.

Final Comments

Elementary schools are busy places. Between arrival, meals, recess, essential areas, transitions and learning activities, students are typically allotted around 300 minutes for core academics. However, providing this time does not guarantee that a child is mentally engaged in learning. To maximize this limited window,

teachers must be exceptionally efficient, balancing instructional strategy with effective classroom management. Ultimately, a teacher chooses the mutually exclusive medium to deliver content, and that specific pedagogical approach is a key factor in determining student social and academic success.

For the last two decades, beginning with my career as an elementary school principal, I noticed a troubling trend: students were not truly absorbing material when using digital resources. I was aware that I personally had issues with remembering content from digital resources that involved keyboarding input on my smart phone or computer. However, the "why" on the root cause of the lack of long-term content consolidation remained a mystery to me until I discovered research from the Norwegian University of Science and Technology (NTNU). The findings revealed a deceptively simple cause, but the implications go much deeper, challenging our over-reliance on digital tools for often ineffective learning.



A digital computer program is not a substitute for an academically engaged student since real progress comes from a caring, relational, motivated, and competent teacher who is supported by a campus administrator that implements targeted global interventions for literacy and numeracy. Digital resources that lack strict accountability and active engagement mechanisms have little impact on the academic challenges of a Title 1 school. Instead of driving results, they often become just another way to occupy the 300 minutes of core instruction until dismissal.

Finally, a significant number of low-income students consistently lag behind their more affluent peers. In my view, digital curricula alone cannot resolve these deep-seated classroom challenges. The root of the problem lies in early academic gaps: the mass of low-income children frequently arrives at school at the age of four or five with existing literacy deficits, which are followed by numeracy gaps fomenting in first grade. These disparities only widen as they progress through school. Without a consistent, practical plan to directly address these specific literacy and numeracy gaps – which are currently lacking in the vast majority of Title 1 elementary schools – academic improvement will remain out of reach. Administrators must move past the "magical solutions" of digital learning games and ineffective, personalized educational philosophies that have failed for decades. It is far past the time to focus on the actual, underlying problems causing chronic student underperformance.