Education Next

FEATURE

Pay Attention, Kid!

Has the use of digital technology impaired students' ability to focus?

By Daniel T. Willingham

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More than half of U.S. states have enacted laws banning or regulating cell phone use by students in school, and most others are considering such measures. Legislators suspect cell phone use has contributed to the dramatic increase in mental health issues among American teenagers, and they are also responding to the common-sense observation that phones, as a potent distractor, make it hard for students to learn. A recent Pew Research survey shows that 72 percent of high school teachers call cell phone distraction "a major problem" in the classroom.

Banning cell phones in school may remove the immediate source of distraction, but are educators facing a bigger problem here? Has the long-term use of digital technologies rendered many students unable to sustain their focus?

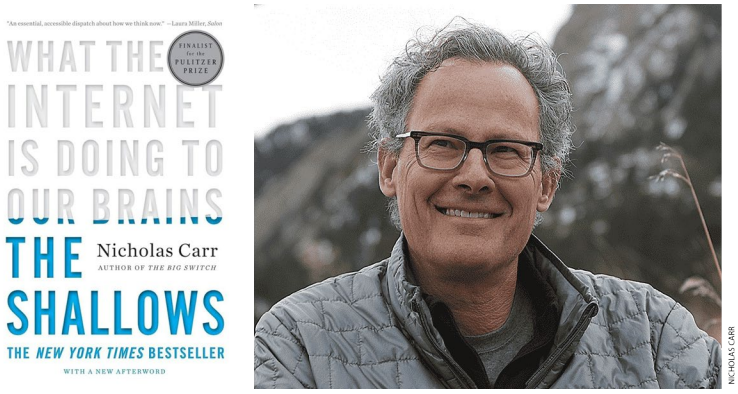
Some observers think so, most famously journalist Nicholas Carr in his 2010 book, *The Shallows*. He argues that the sorts of things we do on digital platforms often demand or encourage rapid shifts of attention. If you play an action video game, your eyes dart around the screen in search of bad guys. On social

media apps, you skim through your feed, scanning for interesting content. And whatever you find yourself doing on a digital device, another app always beckons, so your attention seldom alights anywhere for extended engagement.

Carr also notes that, contrary to earlier scientific dogma, researchers now have evidence that the brain changes with experience, even in adulthood. Considering both our habitual shifts of attention and the changeable brain, he surmises that you unintentionally train your brain to shift attention frequently, and eventually, you have no choice. You can't sustain focus.

Teachers report observing student behavior consistent with that hypothesis. In a 2024 survey, when asked whether their students' reading stamina had changed since 2019, 53 percent of 3rd- through 8th-grade teachers said it had "decreased a lot." Another 30 percent said it had "decreased a little." College professors assert that they see the same problem. Recent articles in *The Atlantic* and *The Chronicle of Higher Education* report that college students at elite universities have trouble sustaining attention to read book-length texts.

Are teachers seeing evidence that Carr was right? Since 2010, a great deal of research has addressed the question of whether digital-device use lessens the ability to sustain attention, and as we will see, the evidence for that is weak. But that doesn't mean these devices have no effect on the ways children (or adults) pay attention. Some studies have examined this question and related ones. I offer for your consideration some alternative hypotheses that potentially explain what teachers are observing in the classroom. For example, it's possible children still *can* pay attention, but they choose not to—perhaps because the immediate rewards of digital devices have rendered them less willing to sustain focus on challenging learning tasks. Or, maybe students today experience boredom more often than children of the past because they unconsciously compare schoolwork to the enticing activities readily available on their cell phones.



In* The Shallows *(2010), Nicholas Carr argued that digital devices not only reward quick shifts in attention but also change how the mind works. Fifteen years later, compelling alternative explanations about the interplay between technology and human attention are gaining credence.

Digital Content Directly Affects Attention

How could researchers determine whether extended use of digital devices leaves people unable to focus? A straightforward test would compare the ability to focus among students who engage in a great deal of digital activity with those who seldom engage in it. Many researchers have taken that tack. They often test children from infancy to about age six separately from older children, reasoning that the young brain is more vulnerable to change.

And the results? For both older and younger children, the average of dozens of studies reveals a modest negative correlation: More screen time is weakly associated with poor attention regulation.

Now, this kind of study has an obvious limitation—it finds a correlation, but correlation is not causation. Thus, although one is tempted to conclude that digital activities negatively impact attention, it's also possible that children who have greater difficulty focusing attention find digital activities more appealing than children who do not have such challenges.

Researchers have tried to address this problem by conducting longitudinal studies. That means they measure screen time and attention (at, say, age nine), and then measure them again in the same children months or years later. If more screen time at age nine predicts worse attentional control at age 11—even after accounting for the level of attentional control at age nine—that suggests screen time may contribute to later attention problems. Conversely, if worse attentional control at age nine predicts increased screen time at age 11, that indicates that attention difficulties may lead children to use screens more. The temporal sequence can help clarify the direction of causality.

Using this method, most studies of younger (birth to pre-K) or older (K–12) children support the hypothesis that screen time is associated with poorer attentional control. The size of the observed relationship varies, but on average, it's small.

Yet even with this improved research design, we cannot be confident that digital activities compromise attention. Other factors could be associated with "more digital activity," and it might be these other factors that diminish attentional capacity, not digital activity itself. More time with digital devices doesn't happen randomly; it tends to happen in certain contexts, and with particular styles of parenting. Parents may allow their child more access to screens in an effort to improve their child's mood or behavior. Or screen activities may keep the child occupied so parents have time for their own pursuits. Wealthy parents may have easier access to pastimes for their child that are not screen-based. In each case, it may be elements of the context that have the critical effect on attention, not digital activities per se.

The same challenge arises when trying to interpret outcome differences that seem attributable to the quality of digital content. Several studies have reported that the impact of screen time on the development of attention in young children depends on what kids *do* during that screen time. These studies suggest that if parents choose educational content and interact with their child while they watch together, screen time doesn't affect attention, but attention is compromised if parents let children watch non-educational programming on their own. But again, if we were to compare parents who did and did not have the time and inclination to select programming and watch it with their children, their households would probably differ in many ways, not just the nature of screen time. So even the modest effect observed via longitudinal studies could overestimate the impact of digital devices on attention.

Still another type of research compares the attention of kids today to that of kids who grew up with more limited access to digital devices. This procedure fits more closely the way the problem is usually framed. When we say, "Kids today just seem unable to concentrate," we are comparing them to our memory of what kids were like 10 or 20 years ago.

Comparing kids today to kids 20 years ago can be done if the same test of attention was administered

to kids in 2005 and 2025. That does happen, because some mental measures become standards, used for years and across many contexts. (Of course, if we see a difference in attention over time, we still can't be sure of what caused it. Lots of things have changed in the last 20 years.)

One study reviewed the results of 179 research reports published between 1990 and 2021; in each study, researchers had administered the d2 Test of Attention, a widely used assessment. In this paper-and-pencil task, the subject sees a sheet of figures and must cross out the targets—the letter D with two dashes over it. The non-targets are Ds with one or three dashes, or Ps with any number of dashes. This task requires that subjects direct attention to specific visual features, inhibit responses to highly similar (but incorrect) items, and maintain focus on a long and repetitive task. Researchers found that children's performance from 1990 until 2021, on average, did not change. Adults actually improved slightly.

Another study examined performance on two backwards-working memory tasks. For one task, the subject heard a sequence of digits (for example, 9, 2, 4) and tried to repeat them in reverse (4, 2, 9). For the other task, subjects were asked to report back in reverse order a series of spatial locations on a computer screen. Data were collected between 1975 and 2016 for the digit version of the task and from 1989 to 2016 for the spatial version, comprising over 135,000 participants in 1,754 samples. The results showed a diminishment in performance across years for both the digit version and the spatial version of the task, with effect sizes of $d = -0.06$ and $d = -0.17$, respectively.

Discerning whether digital activities compromise attention presents a difficult research problem, and based on three different research strategies, one can only conclude that screen time *may* degrade attention. Strong causal evidence is lacking, and the correlation seems to come and go across studies.

And even when the correlation is observed, it's smaller than expected. To understand why I say this, consider the larger of the changes documented by the working memory study, which showed a decline in spatial working memory from 1989 to 2016, with an effect size of $d = -0.17$. Here's an example of how effect size is measured: Imagine two rooms, each containing 30 adult men. The average weight of the men in the two rooms differs: 188 pounds in one room, and 196 in the other, although naturally there's plenty of variation, with tall and short, heavy and slender men in each room. The mean weight of American men is 192 pounds, with a standard deviation of about 45 pounds. To calculate effect size, divide the difference between the two rooms, 8 pounds, by the standard deviation of 45. So, that average 8-pound difference corresponds to an effect size of about $d = 0.17$. Yet, if you saw these two groups of men side by side, do you think you'd notice the 8-pound difference between the groups?

Thus, according to the surveys cited previously, teachers think students are much more distractable than they were in the recent past, but research shows an effect that comes and goes and is modest when it is observed. How can we make sense of this contradiction?

Digital Content Changes Discount Rates

When kids are distractible, it's natural to suspect attention is to blame. But maybe the problem is not that they *can't* pay attention, but rather that they *don't want to*.

Many students find schoolwork challenging and not very engaging. One motivator to maintain attention is the promise of some later reward. That might be the satisfaction of understanding the content, the pride of receiving a good grade, or the avoidance of parental disapproval.

What makes a student more or less willing to endure something unpleasant in exchange for an anticipated reward? How much they value the reward, obviously, but also how long they must wait for it. Immediate gratification is appealing because the same payoff seems less valuable if it's delayed.

Here's the way researchers study this phenomenon. Suppose I offer you a choice: Would you prefer that I give you 10 dollars tomorrow, or 10 dollars a week from tomorrow? Virtually everyone would prefer the money sooner because you have an extra week to enjoy whatever you spend the money on.

Suppose I compensate you for waiting. You can choose between 10 dollars tomorrow or 11 dollars a week from tomorrow. You may figure that one extra dollar does not offer enough incentive to wait a week, and so you'd still pick the 10 dollars now. I can keep making offers—varying both the delay and the amount of money—to figure out your *delay discount rate*—that is, how much compensation would induce you to wait to get a reward. Some people hate to wait, and I might need to promise $20 (versus an immediate $10) to get them to wait a week, whereas others would require only an extra dollar.

Researchers identify a high delay discount rate as an aspect of impulsivity; a more impulsive person will grab a smaller reward that's available now, rather than wait for a larger reward later. Standard measures of delay discount rate are obtained by asking participants to answer about 30 questions like the one posed earlier ("Would you prefer 10 dollars tomorrow or 20 dollars in eight days?").

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It's possible that the use of digital technologies has changed children's delay discount rates for the worse because instant gratification is such a prominent characteristic of digital activities. When you're on a phone or computer, there is little reason to endure boredom because there is always something else you might do on the device. What's more, accessing that alternate activity is *easy*—you just keep scrolling, or you switch apps. Perhaps that impulsivity carries over to other activities. Students *can* pay attention, but if they get bored they quickly switch their attention to something else.

Some research supports this proposal. People who show "problematic use" of the Internet in general or of specific apps like Facebook (as identified by self-report measures) show higher discount rates than average users.

Of course, we're interested in more than problematic use. Do we still see a relationship between delay discount rate and digital activity among more typical users? The answer is a tentative "yes." A few studies show a consistent, but still modest (d = approximately 0.25), relationship between technology use and delay discount rate. These studies have used different measures of tech engagement, including self-reported screen time, actual screen time measured on the device, and self-reported time on social media. Thus, the observed relationship with delay discount rate is not a quirk of which measure of digital-device use we happened to pick.

Further, a high delay discount rate is associated with poorer grades in college students and with failure to finish high school.

In sum, the hypothesized causal chain is that using digital devices increases the delay discount rate, and a higher delay discount rate causes poorer academic performance.

But the picture remains incomplete. As before, we are interested in causal links, but the available data are largely correlational. And delay discount rates may have not been measured in the best way. That is, researchers typically determine an individual's rate by asking them to answer questions about money. But when students divert their attention to their phones, they aren't getting a financial reward but rather one of information. If I delay getting a financial reward by a week, the money still has the same objective value, even if I think of it differently. But if a student delays reading a text message or checking social media, the information may lose value. Social information is perishable.

There is limited research on the subject, but one study of college students suggested that the value of money decays over the course of weeks, whereas the information in text messages decays in hours. Researchers may find that delay discount rates are a stronger predictor of distractibility if they measure discount rates for digital content. For example, one study shows that delay discount rate of the value of texting predicts the likelihood of texting while driving, whereas delay discount rate for monetary reward does not.

The Availability of Digital Content Changes Boredom Calculations

Perhaps the same content that was interesting enough to hold the attention of students a generation ago might be deemed boring by today's kids. It's easy to dismiss this account as an example of generational bias. Don't older people always think that they, as children, were superior to today's youth? But

psychological theories of boredom suggest there may be more to it than that.

Contemporary theories of boredom emphasize its function. Boredom alerts us to change activities because we judge that whatever we're doing now has less value than something else we might do. What goes into our calculation of "value" varies by theory. For example, one theory suggests that we feel bored when we detect a mismatch between the current activity and our valued goals, and another proposes that we experience boredom when we sense we aren't learning anything.

However "value" is calculated by the mind, if boredom's function is to prompt a change to a more fruitful activity, that implies the existence of a mental mechanism to calculate opportunity costs. The tediousness of the current task is based not only on the characteristics of the task, but also on an unconscious comparison with what else you might be doing. Thus, you feel more bored when another available activity is deemed more valuable than the current one.

That sensitivity to context seems plausible, or even likely. For example, consider a student who finds a novel interesting when she's on an airplane and has forgotten to charge her phone. Might she not deem the same novel less interesting if her phone were charged? She would likely be bored, because she would (unconsciously) compare the interest of the novel to that of watching YouTube videos.

Some research supports this proposal. In one experiment, subjects were led to a small room where they were told to sit for 15 minutes and "entertain themselves with their thoughts." For half the subjects the room contained only a desk, chair, filing cabinet, and chalkboard without chalk. For the other subjects, the room had a laptop with an open web browser, a partially completed Lego puzzle, a partially completed jigsaw puzzle, sheets of paper with crayons, and chalk for the chalkboard. Participants in this room were instructed not to interact with the objects, but to just sit with their thoughts.

At the end of 15 minutes, subjects rated their experience on several scales, and the people who were in the room that held interesting activities reported significantly more boredom than the people who were in the empty room.

Compared to students a generation ago, students today may feel bored more often because they may nearly always find themselves in environments filled with fun activities they are not doing. In other words, students may unconsciously compare whatever they are doing to the fun activities available on the phones in their pockets.

Other correlational data comport with this idea. Much research shows a correlation between cell phone use and boredom; that is, people who report that they are frequently bored also report using their cell phones a lot. It's possible that causation moves in the other direction—that people who are easily bored turn to their phones more often to relieve their boredom. But there are also data showing that people feel more bored and more distracted *after* using their cell phones, perhaps because having recently used the phone is a reminder of how engaging digital activities are.

STEPHEN FROST / ALAMY

Some studies show the value of information decays much more quickly than that of money. The longer the delay in acquiring information through digital devices, the less valuable it becomes, giving social developments a higher payoff for immediate attention.

Implications

How might the results reviewed here influence the thinking of parents, educators, and policymakers when it comes to children and digital activities?

The first conclusion is both cheering and dispiriting. Digital devices do not seem to degrade students' capacity to pay attention, which is clearly good news. But at the same time, it's useful to know the nature of your enemy. Despite a paucity of hard data on the matter, I believe the overwhelming majority of teachers when they say that it's more difficult to get students to stay on task than it was a generation ago. How are we supposed to address the problem if we don't know what's causing it?

I've offered two alternative explanations for what teachers have observed, each a version of this idea: It's not that students can't pay attention, but rather that they more readily choose not to. The delay discounting story suggests that experience with digital devices makes students set a higher value to near-term rewards, and a lower value to rewards they anticipate getting in the distant future. The boredom explanation suggests that digital devices prompt students to more readily conclude they feel bored because all non-digital activities are unconsciously compared to entertainment on their phone, and the phone always seems more attractive.

I've reviewed data supporting each hypothesis, but there's insufficient convincing research that either (or both) play a substantial role in the observed change in children's behavior. Still, we should probably hope these explanations are valid, because both suggest that the degradation of attention has been learned. And what is learned can potentially be unlearned.

If digital devices make students overvalue near-term rewards, perhaps children can be coaxed to reassess the importance of long-term rewards by making them more explicit or salient. For example, portfolios of student work might help students see and appreciate how much progress they have made in the quality of their work throughout a school year and reflect on the necessity of hard work to access the satisfaction that progress brings.

If digital devices prompt students to set a low threshold for concluding "this is boring," it may be that, with the consistent absence of digital devices, the unconscious mind will learn that the phone is unavailable in a particular context, and so the calculation of boredom will adjust accordingly. We might hope that cell phone bans in school would induce such learning, and one would predict that students would learn it more quickly with bell-to-bell bans (rather than a piecemeal approach) because they would develop a consistent association between "school" and "no phone." Indeed, schools and districts could help test this hypothesis by gathering relevant data as bans are implemented (and perhaps rescinded).

We should keep in mind that children's use of digital devices may have consequences across a variety of outcomes, touching on their mental health, physical health, social-emotional skills, and academic performance. This article has reviewed data on just one cognitive outcome, namely, attention. In addition, it has focused on long-term consequences. The short-term consequences of digital-device use are well known—they frequently distract users from other tasks. Clearly, any recommendations for children's use of digital devices must take a broad view of likely outcomes.

That said, attention forms the nexus of thought; it is essential for all of the cognitive processes we want students to develop, such as reading deeply, solving problems, and thinking creatively. If students' use of digital devices is degrading their ability to deploy attention effectively—and teachers are veritably screaming that it is—that phenomenon should be near the top of our priority list for education research and policy.

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