This is Your Brain on Social Media: How Social Media Use is Changing our Attention Spans

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Abstract

Social media has dramatically reshaped human interaction and cognition. It influences how people communicate, behave and process information. Even though it does have its benefits, such as enhanced communication and global connectivity there are also negative impacts. One critical area of concern is the effect of social media on attention span, especially among the younger generation. This effect has been exacerbated by the rise of short form content which has encouraged behaviors driving instant gratification. This review summarizes studies that have been done on social media and its correlation with attention span. The majority of psychological and neuroimaging studies show that excessive time on social media correlates with shorter attention spans, reduced academic performance, as well as poorer mental health and overall well-being. However, not all research supports this conclusion with some studies showing no significant correlation between social media usage and attention span. The mixed results highlight the need for more comprehensive studies that can account for these nuances. Future research should adopt more longitudinal studies and a standardized attention span test in order to completely understand the correlation of social media on attention span.

Introduction

Social media has taken the world by storm and undoubtedly affects most aspects of daily living – how we think, how we act, how we travel, and even how we order food. While social media has certain benefits, such as connecting the globe and exchanging information quickly, there are significant drawbacks as well. In contrast, for much of human history, the only way to receive information before all of this was through reading. During this time, William James, who holds the nickname the “Father of American Psychology,” started to explore the nature of attention. He published a seminal book in 1890 called “The Principles of Psychology” and gave the following definition for attention: “Attention is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought” (James, 1890).

As technology evolved, society moved from reading to radio, radio to television, television to personal computers, and eventually, smart phones. With each step, the rate and ease of communication increased exponentially, and consequently, so did the connectedness of the world. Early online communication took place in chat rooms, which provided real-time social interaction in an easily accessible way. Social media then naturally evolved and further accelerated the connection of people online. The first social media platforms, Six Degrees, Friendster, and MySpace were created in the late 1990s and early 2000s (Hafeez, 2024). In 2004, the first social media that reached one million active users every month was MySpace. Facebook also launched in 2004 and gained global popularity due to its user-friendly interface

and the ability to connect with a big audience. Facebook originally started as a network only for Harvard students, but then expanded to college students, high school students, or workers. It then opened to anyone over 13 years old in September 2006 (Richter, 2019). In just 15 years, from 2004 to 2018, Facebook grew from zero to 2.3 Billion active monthly users worldwide (Richter, 2019). Facebook was so unique because it would include targeted ads towards specific users (Richter, 2019). Facebook also had a "clean and non-customizable design," when MySpace did not (Press, 2022). This reinforced innate social desires such as being liked, seen, and connected with others, causing individuals to become easily hooked and subsequently averse to disconnecting from the internet.

Shortly after, platforms like Twitter, Instagram, and Snapchat emerged, each one having unique features catered to their users. A very popular one today that revolutionized short-formed content is TikTok, which was released in 2016. It has become so popular that TikTok's website was visited more frequently than the Google search engine (Harwell, 2022). It was the fastest application to gain one billion users with 100 million of them residing in the USA (Harwell, 2022). Highlighting its addictive nature, statistics indicate that the average American viewer scrolls on TikTok for 80 minutes a day, which is more time than the average minutes Americans spend on Facebook and Instagram combined (Harwell, 2022). It is specifically very popular amongst teens, as two-third of American teenagers have TikTok (Harwell, 2022). Additionally, according to a Pew Research Center survey, 1 in 6 American teens say that they watch TikTok "almost constantly" (Gottfried et al., 2023). The same survey showed that half of Americans on TikTok are under 25 years old (Gottfried et al., 2023). Looking further into TikTok, it is not just a dance app, it is an app that is shaping new generations on how they act, think, and view the world. Considering this, an important question arises: How is social media impacting the younger generations of America?

Dr. Anna Lembke, an expert on addiction, has concerns about the addictions that people have to their smartphones today, such as how there are people who check them every couple of minutes as if it were a tic (Waters, 2021). She believes that it has impacted us negatively as data shows that there are increases in depression rates and a decrease in happiness in richer countries within the last decade, possibly through its effect on the dopamine reward system. Dopamine is a neurotransmitter that makes us want to do things to seek pleasure, such as us wanting to eat something good when we are hungry (Waters, 2021). The connection lies in the fact that higher dopamine release increases the likelihood of addiction. This drives our frequent urge to check our phones, anticipating new notifications. An addiction that has been a result of this is called Problematic social media use (PSMU). PMSU is typically reserved for teenagers or younger adults and refers to the fact that they cannot healthily control themselves when using social media.

Since its initial study in 1990, internet addiction, particularly problematic social media use (PSMU) has become more prevalent, exacerbated by the COVID-19 pandemic, leading to increased stress, reduced social interaction, and strained relationships in various aspects of daily life (Tereshchenko, 2023). This generation who grew up with all these new apps and

devices is now within the adolescents and young adult range. Ultimately, “research suggests the average attention span may be decreasing, and that may be problematic” (Moulton, 2024). A 20 year study conducted by Northeastern University found that the time that one is able to focus on one thing has decreased from 2 and a half minutes to only around 45 seconds (Moulton, 2024). Although there are limitations in the acquisition method, since there is no standardized measure of attention span, these results suggest that attention span is decreasing throughout society, perhaps unsurprisingly, in parallel with the rise of social media use. But how does a reduction in overall attention span affect society broadly?

To start, social media has a drastic impact on students because it affects their learning greatly. According to an article from Santa Maria college, shorter attention spans affect students because it lessens their ability to do well on tests and retain long-term information (Oaten, 2024). This is not healthy nor good for the younger generations because learning is very important in order for people to develop skills, knowledge, and gain more understanding. The root cause of this issue is seemingly social media, and its impact extends across academics. The digital distraction that is prevalent during many hours of the day affects people’s stress levels and their cognitive fatigue by heightening them (Oaten, 2024). Oaten states that, “When the brain is constantly in a state of overdrive, trying to reorient between different stimuli, it becomes increasingly difficult to achieve the calm, focused mindset needed for optimal learning and wellbeing.” It is a problem that is increasing in society as social media is becoming more prevalent and teenagers often go through mental health problems as they are developing. Teenagers during this time are still establishing their identity and going through puberty (“The Social Dilemma: Social Media and Your Mental Health,” 2024)

Social media companies are aware of this issue and have taken steps to try and help out such as Instagram including a feature to hide the amount of likes someone gets on a post. Even though it is a small step, there are still loopholes that exist as there are other ways for people’s mental health to be affected through comments or comparing themselves to others. FOMO (fear of missing out) is increasing in teens as social media is used to share parts of your lives and this may make someone feel bad that someone else did not invite them or is having a funner time than them (*Social Media’s Impact on Our Mental Health and Tips to Use It Safely*, 2024) FOMO can also cause users to keep checking social media very frequently so that they do not miss out on what their friends, family, or others are up to.

Social media can also indirectly affect attention by impacting mental health. Cyberbullying is unfortunately prominent throughout social media and can lead to “depression, anxiety, severe isolation, and, tragically, suicide” (O’Keeffe et al., 2011). Researchers have even named a new type of depression called “Facebook depression.” It occurs when preteens and teens spend a lot of time on social media and start to experience symptoms of depression (O’Keeffe et al., 2011). This puts them at a risk of being socially isolated and can sometimes make them dive deeper into social media or risky internet sites for “help that may promote substance abuse, unsafe sexual practices, or aggressive or self-destructive behaviors (O’Keeffe et al., 2011).” This is not healthy for preteens and teens and negatively affects their daily lives. It will be hard to focus and

learn at school when they are constantly thinking about social media and how it negatively affects them. It will also affect how they interact in real life with their friends, family, teachers, and others. It is hard for them to realize that they need a break and could only cause them to stay active on social media.

Short form content is exacerbating the situation of the attention spans allegedly shortening. TikTok has significantly transformed social media in recent years. Since they specialize in short form videos, these platforms are particularly vulnerable to excessive use or addiction by users. Short form videos are supposed to be more entertaining and make it really easy for a user to watch a different video if they are bored or uninterested (Xie et al., 2023). This causes users to watch for a while because TikTok's algorithm is specifically designed to play videos the user enjoys or has more watchtime on to keep them on before the user taps out and manually stops. This negatively impacts viewers by making it easy to switch between personalized videos, which lowers their attention span. The user has the opportunity to experience satisfaction immediately in a very short amount of time (Xie et al., 2023). If the user is not satisfied, they are immediately given the chance to watch a different video.

Social media has transformed the way we communicate and access information, but it has also introduced challenges, especially for younger generations. With the rapid rise of platforms like Facebook, Instagram, and more recently TikTok, the potential for addiction and its detrimental effects on attention spans, mental health, and overall well-being has become a pressing concern. It is essential to examine how these platforms shape behavior and cognition among adolescents. By examining current research findings, we can gain valuable insights into the effects of digital engagement and the need for strategies to support the youth mentally. The next section summarizes findings from neuroimaging and psychometric experiments aimed at uncovering the interaction between social media and attention span.

Current Research

With concerns about social media's potential impact on attention spans and mental health rising, numerous studies have been conducted to explore its effects in detail. These investigations have provided insights into how social media usage influences academic performance, attention networks in the brain, and the development of addictive tendencies. The following section will present key research findings, highlighting how excessive social media use may negatively impact people.

In one experiment Pelling and White (2009) surveyed 233 undergraduate students who were 64% female and had an average age of 19. A model of the theory of planned behavior was used on the students to predict use intentions and actual SNS (Social Networking Sites) usage. Using SNSs at least four times a day was categorized as high-level usage. The key findings were the factors that go into predicting SNSs usage. The factors that had a big impact to determine actual behavior were "past-behavior, subjective norm, attitude, and self identify." There was a positive correlation as those who were higher on the level usage were more prone

to developing an addiction. It shows that these social and psychological factors play a critical role in shaping not only the intention to use SNSs but also the likelihood of addiction.

In an article titled “Effect of online social networking on student academic performance” researchers from Kennesaw State University conducted an experiment on undergraduate students enrolled in business courses. An anonymous survey was given out to students from fifteen total sections of different classes at the lower, middle, and upper-level range. The students had an average age of 26.73, a 48:52 male-to-female, and an average GPA of 3.19 (Paul et al., 2012). The survey questions were about time spent on social media sites, predictors of behavior, time management skills, academic competency, attention span, student characteristics, and academic performance. The survey identified a direct correlation between some variables, while other relationships were proven to be irrelevant. For example, time spent on social media was shown to negatively impact academic performance, “As time spent on social networking sites increases, the academic performance of the students is seen to deteriorate” (Paul et al., 2012). There was also a connection between time spent on social media to attention span. Decreased attention span had a positive correlation with those had increased hours on social media. Since time spent on social media negatively impacts them academically, there is also a relationship between decreased attention span and academic performance. There was a correlation between decreased attention span and those who had negative academic performance.

Another study sought to find how social networks affect our brain, specifically our attention networks (Lee et al., 2021). The study involved 78 participants aged 16-27, who were then divided into two groups. Half were problematic social media network users measured by the Korean Smartphone Addiction Proneness Scale and the other half who were healthy and controlled. They were all evaluated for smartphone addiction and other psychological factors. One way they were tested was using the Korean Smartphone Addiction Proneness Scale (SAPS), which is used to assess excessive smartphone use. This focuses on those who only use smartphones for communicating online and social networking. They answered questions on their social media use, the frequency and duration of their activities. MRI scans were also used to examine parts in the brain where the attention networks are located. Results revealed that those with PSMU had a weakened connection between regions in the brain’s attention networks. They discovered stronger connectivity in other areas of the brain, suggesting a possible alteration in how attention is managed. In the end, it was found that PSMU has a direct impact on how our brain functions, particularly in the regions related to attention and impulse control.

However, not all research trends in the same direction. In a 2023 study, researchers studied 70 Nigerian participants ranging from low, medium, and high social media usage for effects of social media on GPA (Lara & Bokoch, 2021). The participants were given 10 cents USD to complete a questionnaire. Results showed that no relation was found between social media usage and being able to suppress irrelevant or distracting information. It may be difficult to generalize this data to a US population since the participants were from Nigeria. There are

cultural differences in the use of social media. They did come to the conclusion that attention does affect GPA, however there is no direct correlation between social media use and GPA.

A study in Mumbai tested how social media use affects attention span, focusing on delayed gratification, which is resisting an immediate impulse for a greater reward later (Sriram, 2023). The experiment was done on 41 students from 16-18 years old from JBCN International School in Mumbai. The students answered questions about social media screen time and took the Stroop Color and Word Test to measure distraction resistance. The Stroop test measures cognitive controls by asking participants to name the color of a word that spells a different color, such as the word red written in blue lettering. Students were then grouped into low (0-2 hours), medium (2-4 hours), and high (4+ hours) social media usage. In the survey, Instagram was found to be the most popular with 67.4% of people using it (Sriram, 2023). Other social media sites included Twitter, Snapchat, YouTube, and Whatsapp. Results showed that high social media usage was linked with a decreased ability to delay gratification. In the Stroop task, there was no significant difference in Stroop test performance between high and medium users. Overall, there was not a significant negative impact of high levels of social media on attention span.

High school students in Bangkok were also surveyed about short-form content and their daily tasks that require attention through a Google Form in early 2023. There were 39 questions that consisted of “four sections: general information, short- form video use, background information on attention-deficit hyperactivity disorder (ADHD), and modified everyday life attention scale (ELAS).” It was recorded using a 5-point Likert Scale. Thai teenagers between the ages of 15-24 were found to read the most daily, 109 minutes (Triam Udom Suksa School, Bangkok, Thailand et al., 2023). The Thai students that were sampled were from public school, private school, and international school. Most of the students had an average GPA of 3.5. Most of the students (67%) used Instagram for exploring short form content, followed by YouTube (66%) and TikTok (53%) (Triam Udom Suksa School, Bangkok, Thailand et al., 2023). 72% of students said they used short form content to relieve stress, 64% said that they watched just because they were bored, and 40% said to keep up with trends. Data shows that 35% of participants watched shorts for more than 1 hour per day. The analysis showed that there was no negative correlation between the rate at which one watches short form videos and their everyday life attention span. However, ¼ of the students craved short form content during study or learning times, which shows a link between addiction and decreased learning motivation and psychological well-being. It stated that since it was only 60 participants, it may not represent the broader population accurately. In the end, there was no direct correlation between short formed content and attention capacity.

A different study was done in Geneva, Switzerland, at a public primary school with kids between the ages 8 to 12 years old. There were a total of 118 children with a girl to boy ratio of 57:61 with an average age of 10.38 years (Cardoso-Leite et al., 2021). They were given a variety of questions about “digital technology use; attentional problems; mental health and sleep; grades, motivations and beliefs” (Cardoso-Leite et al., 2021). They were also given

cognitive tests that relate to attention: one about their speed, another about not paying attention to something when they should have, and lastly about when they respond to something when they should not have. These tests included numbers appearing on a screen and telling the kids to click when they see their target number, and flashing an array of letters and asking children if it contained the target letter. Results from the survey included that children who are 8 years old spend an average amount of 4 hours and 28 minutes of screentime per day and those who are 12 years old spend an average of 8 hours and 14 minutes (Cardoso-Leite et al., 2021). There was little to no difference between boys and girls. It was also found that technology use has little to no relationship with grades.

A separate study in Chungbuk province, Korea, was conducted with middle school boys. They first determined internet addiction by using the Korean Adolescent Internet Addiction Scale (K-AIAS), which is a questionnaire. They selected 15 participants with addiction and 15 non-addicted kids, forming pairs based on age. Specifically, they split them into 6 pairs of 13 year olds, 5 pairs of 4 year olds, and 4 pairs of 15 year olds. (Kim et al., 2014). They then were given a test in which they had to decide whether a symbol that appeared on the screen was on the right or the left. There were different versions where some had no reward, a feedback award saying “Correct” or “Right,” a social reward which included the words “Great” or “Good,” and an actual reward that gave them money if they answered correctly (Kim et al., 2014). The test lasted about 6 minutes. Results show that those with internet addiction had lower brain activation in several areas in the brain when compared to those who are non-addicted (Kim et al., 2014). It was found that the non-addicted group found feedback rewarding when those with addiction may have not. The reason the addicted group had reduced activation in the brain was due to their longer hours spent online. It is shown that more hours online has affected the brain negatively.

The research on social media’s impact on attention span and overall mental health is diverse and ongoing. While many studies reveal a clear negative correlation between excessive social media use and attention-related issues, such as impulsivity, diminished academic performance, and addiction tendencies, other studies show more nuanced outcomes, with some finding no direct connection. The evidence suggests that while social media has potential to harm attention networks, its impact is not universal and further research is necessary to fully understand its long term consequences.

Conclusion & Future Directions

While research on social media’s connection to attention span has shown both insightful and conflicting results, it is clear that more long-term, comprehensive studies are necessary. One major limitation in current research is the scarcity of longitudinal studies that could show how attention spans evolve in relation to prolonged social media exposure. Most existing studies are short term, which limits their ability to make definite claims about causality or long-term effects. To better understand these effects, future studies must follow participants over time to

observe how consistent social media use impacts cognitive abilities, mental health, and attention span development across different stages of life.

Another confounding factor lies with the way that researchers measure attention span. The methodologies often varied across studies, and this creates challenges for drawing consistent conclusions. A simple and effective way to address this issue is to develop a universal cognitive test that measures attention across various dimensions, like sustained focus and task-switching, in both controlled and real-life environments. By adopting a standardized test for measuring attention span, researchers could better compare results and form a more accurate understanding of attention span. There are many different tests that measure attention span such as Cognitive Assessment System (CAS), Cognitive Assessment Battery (CAB), The Madrid Card Sorting Test, and many more (Nasiri et al., 2023).

Furthermore, while the majority of research focuses on attention span, social media's broader impact on psychological traits such as depression and anxiety has also been well-documented. Researchers have found that preteens and teens who spend a great time on social media develop depression (O'Keeffe et al., 2011). The status and popularity on social media may cause those who develop anxiety to have a perfect image. A perfect image refers to having an idealized self representation on social media, making it look like one has a flawless appearance. The studies did show that there is a strong correlation between high social media usage and increased levels of anxiety and depression, especially in adolescents.

Another important consideration in experimental design is the format of social media being consumed. Some platforms offer more short-form content while others implement longer form (Zhang, 2024). This is because platforms like TikTok, with its emphasis on short-form video content, may have different effects on attention span compared to longer-form platforms like YouTube. Short-form content encourages rapid consumption, which could train users to expect instant gratification and make it harder for them to engage in more prolonged, focused tasks (Coleman, 2024) This can help us understand whether certain platforms or content forms have a more detrimental effect on attention span than others.

Future studies should aim to incorporate advanced neuroimaging techniques like functional near-infrared spectroscopy (fNIRS) to gain a deeper understanding of how social media usage affects brain's attention networks in real-world contexts. fNIRS allows for non-invasive monitoring of brain activity in natural settings. The Kernel Flow headset is a wearable device that facilitates accurate data from the brain (Ban et al., 2022). Another company, Neurode, recently developed a wearable headband that purports to track and treat ADHD symptoms (Szkutak, 2024). The headband "uses light electrical stimulation in the prefrontal cortex to balance the brain." This helps with symptoms such as lack of focus. To investigate the impact of social media on attention span using Neurode's innovative wearable headband, an experiment could be done in which participants wear the device while engaging with their smartphones. By using the device's ability to track the prefrontal cortex's response to various stimuli, we can analyze how the brain reacts during different types of social media use in a variety of relevant contexts such as in a classroom or at home.

The experiment would involve participants using their phones for a set period, engaging with different types of content like scrolling through feeds, watching short videos, or reading longer articles. The Neurode headband would track changes in brain activity during these sessions, focusing on areas related to attention and focus. By comparing the data from these sessions to baseline measurements taken while the participants are engaged in non-digital tasks, we can observe how different forms of social media impact brain function and attention span.

Additionally, we can use the Neurode device's light electrical stimulation capabilities to see if it can mitigate any short term negative effects of social media on attention. For long-term effects, we can compare brain activity in two groups, one that has social media addiction and one with healthy usage when faced with a task that requires attention span. Other companies are also seeking to revolutionize mental healthcare such as EMOTIV, which uses EEG, and this could be used too in experiments to track electrical activity in the brain. Using real time data on neural activity could offer valuable insights into the connection between social media use and attention span, deepening our understanding of its cognitive impact.

In recent years, the rise of social media has prompted a deeper exploration into its effects on brain function and behavior, specifically attention and cognitive control. Understanding the effects of social media on attention span is crucial in a world where digital interaction dominates our daily lives. This review has covered the history, current state, and future directions of the neurophysiology of social media use. By focusing on this evolving landscape, we can foster healthier engagement with social media and promote better cognitive outcomes for all users.

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