

Screen Dependency and Brain Health: Investigating the Effects of Technology on Cognitive Performance

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Abstract—The usage of digital devices, prominently computers, and mobile phones has been booming, and it is a quite significant part of our life. But people are inherently not used to this technological approach in our daily lives. To analyze the influence of digital devices, this study uses primary data analysis to understand the impact and secondary data is used as references from entities from various academic articles and journals. Correlation and regression models are used to analyze the impact on the brain. By examining the data, this study has figured out that the use of digital devices has a substantial impact on students' cognitive function and psychological well-being, depending on screen time and digital activities. Too much time in front of a screen might interfere with sleep, which can harm one's memory and conduct. Furthermore, several studies show that those who are addicted to the internet or games experience grey matter atrophy. In conclusion, the influence of technology on our brain health is substantial, bringing about advantages as well as drawbacks. Although gadgets such as smartphones and computers can improve our skills and connections with others, excessive usage may have impacts on our mental functions. It is essential to grasp this equilibrium as we incorporate technology into our routines.

Index Terms—Digital device, Brain health, screen time, technology, cognitive function.

I. INTRODUCTION

By providing formerly unheard-of access to knowledge, communication, and entertainment, the fast spread of digital gadgets such as cellphones, computers, and tablets has changed modern civilization. Still, growing reliance on digital technology begs questions about how it can affect mental and emotional well-being. While digital gadgets can boost productivity and connectivity, their excessive usage is associated to cognitive deficits and mental health difficulties, including lower concentration, disturbed sleep habits, and emotional instability. According to studies, spending too much time in front of a screen could damage cognitive capacity, leading to problems including Attention deficit hyperactivity disorder

(ADHD) and depression. Moreover, research has revealed that chronic usage of digital media alters brain architecture, consequently compromising memory and cognitive control. This study intends to investigate the different effects of digital device usage on brain function, utilizing both primary and secondary data analysis to provide a thorough knowledge of its consequences for human cognition and mental health. This research tries to highlight the balance between the benefits and potential downsides of technology integration in everyday life through statistical models such as correlation and regression.

II. LITERATURE REVIEW

This raises concerns about the potential damage to cognitive function and brain health from using digital devices more frequently. Excessive screen time, particularly from video games, has been connected to attention problems in children and adolescents, according to study [1]. A meta-analysis validated the association between media exposure and young people's ADHD-related behaviors [2]. It has been proven that young children's language development and executive function are greatly impaired by excessive screen usage [3]. Furthermore, anomalies in hippocampus volume are among the structural brain changes induced by digital addiction, such as Internet Gaming Disorder (IGD) [4]. Research indicates that seeing screens shortly before bed may contribute to low-quality sleep, which in turn may accelerate cognitive decline [5], [6]. Children who use screens regularly have decreased white matter integrity, which is critical for the development of language and literacy [7]. Like pharmacological addiction, digital addiction creates structural modifications in the brain that may have long-term psychological repercussions [8]. Since media multitaskers demonstrated more distractibility and increased prefrontal cortex brain activity, it has also been established that media multitasking shortens attention spans [9]. Digital media use has also been tied to mental health

problems like sorrow and anxiety [10], and excessive screen time has been linked to sleep troubles that exacerbate these mental health illnesses [11]. Research suggests that reading from a screen lowers productivity and comprehension as compared to reading on paper [12]. In addition, extended use of digital devices affects the structure of the brain in generating irregular and critical for motor control and navigation. [13]. One of the most concerning part is that studies shows that brain connectively with other parts of the body is lower while using any digital screens [14].

III. METHODOLOGY

A. Study Type

This research analyzes the influence of digital devices on cognitive and physiological findings using a cross-sectional quantitative method among university student. The study investigates the links among daily screen time, social media engagement, and essential traits associated with mental health, cognitive function, and physical well-being. The target demographic comprises students aged 18 to 22 years from the American International University-Bangladesh who were polled to acquire primary data for analysis.

B. Data Collection

Primary data were acquired from a sample of 150 students who participated in a standardized survey. All respondents reported having no prior brain health difficulties to account for underlying diseases that could impair cognitive performance or well-being. The survey measured two key independent variables: Screen on time (in hours/day): divided into five groups (9+ hours, 7+ hours, 5+ hours, 3+ hours, and 2+ hours). Time spent on social media (in hours/day): a continuous variable measuring the average daily time spent on social media sites.

The remaining variables, which are graded on a 5-point Likert scale where 1 represents "very low" and 5 represents "very high", include:

Memory Retention: self-reported ability to retain information. Attention Retaining Ability: self-assessed ability to keep concentration and attention. Mental Fatigue: self-reported experiences of mental weariness. Headache Frequency: frequency of suffering headaches. Emotional Stability: perceived emotional balance and resilience. Sleep Quality: self-assessed total sleep health. Eye Strain: self-reported strain or discomfort in the eyes. Sleep Disturbances: frequency and intensity of sleep interruptions.

C. Statistical Analysis

A combination of descriptive statistics and regression modeling was used to evaluate the connections between screen time, time spent on social media, and different cognitive and physical well-being indices. A simple linear regression model was utilized to evaluate the direct influence of screen time on each dependent variable, such as mental weariness, attention sustaining ability, and memory retention. A regression model is introduced to access the combined influence of screen on

time and time spent on social media on dependent variables like mental fatigue or emotional stability. The regression model give as valuable insights into the predictive mental fatigue situations due to excess usage of digital devices. ANOVA was used to establish the overall significance of the models and analyze relations between variable and outcomes. SPSS was used to perform every statistical analysis in the study.

IV. RESULTS AND ANALYSIS

From the study of the obtained material, we have found out that many people of this generation (university students) are highly dependent on digital devices such as mobile phones, laptops, televisions, etc. As a result, individuals experience a variety of obstacles, like concentration issues.

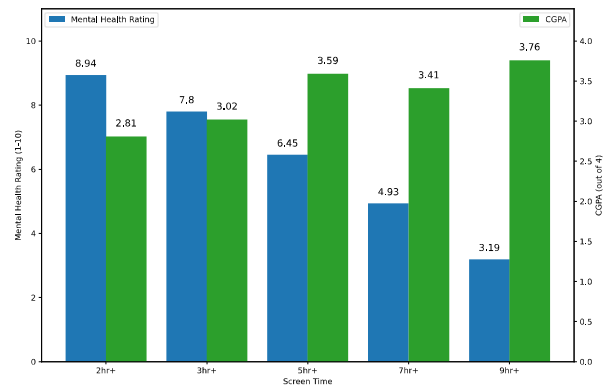


Fig. 1. Diagram on Impact of Screen on Time on Mental Health and Academic Performance.

The graph depicts the effects of screen time on academic performance index (CGPA) and mental health rating that they themselves feel about academics and the entire day to daily living. These correlations are clearly demonstrated in the bar graph heading "Impact of Screen on Time on Mental and Academic Performance." As screen usage develops, there is a noticeable decline in CGPA and mental health ratings. Pupils who utilized screens for more than nine hours a day had the lowest CGPA (2.81) and average mental health grade (3.19). People who utilized screens for roughly two hours each day had the biggest average mental health rating (8.94) and the best CGPA (3.76). These results underline the significance of reducing screen time for general health and academic success, suggesting that increasing screen exposure may be deleterious to both mental health and academic outcomes.

TABLE I
ANOVA OUTCOMES OF THE REGRESSION VARIABLES

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	43.803	2	21.902	50.917	.000
Residual	20.217	47	0.430		
Total	64.020	49			

a. Dependent Variable: Mental Fatigue b. Predictors: (Constant), Time Spent on social media (hours/day), Screen on Time (hours/day)

TABLE II
REGRESSION ANALYSIS RESULTS

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
	B	Beta			
(Constant)	4.944	0.231	-	21.45	0
Screen On Time (hours/day)	-0.221	0.062	-0.579	-3.585	0
Time Spent on Social Media (hours/day)	-0.13	0.076	-0.274	-1.695	0.1

a. Dependent Variable: Mental Fatigue

Screen time and mental fatigue illustrated a critical negative relationship, as shown by the relapse examination ($\beta = -0.221$, $p = 0.001$). This recommends that, in common, mental weakness diminishes for each extra hour went through before a screen. The standardized beta coefficient ($\beta = -0.579$) prescribes that screen time includes a tremendous influence on mental weariness and insinuates to the complexity of screen utilization, which may be changed by exercises or person adjusting strategies. On the other side, there's a negative although unassuming affiliation between mental tiredness and social media introduction ($\beta = -0.129$, $p = 0.097$). Indeed, as the drift suggests that higher social media utilization brings down mental tiredness, this finding does not approach factual importance, demonstrating that the interface between social media and mental weariness may be more nuanced and affected by unexplained variables. To totally look at this relationship, extra requests are necessary. The by and large pertinence of the relapse demonstrate is tried by the ANOVA discoveries. With a remaining fluctuation of 20.217 and an entirety of squares for relapse of 43.803, the show clarifies a considerable rate of the variety in mental tiredness. Together, the impacts of screen time and social media utilize significantly clarify fluctuation in mental tiredness, as uncovered by the F-statistic (50.917, $p < 0.001$). With a significant converse association, the relapse and ANOVA analyses suggest that screen time could be a key component in anticipating mental tiredness. The solid F-statistics and p-value show the by and large model's major significance, even if the slant toward diminished exhaustion isn't factually significant when it comes to the sum of time that went through on social media. To totally comprehend the impact of normal and agreeable screen time on compulsion and other components of cognitive and mental well-being, extra think about is essential.

in rest quality. Since the p-value is more notable than the typical significance limit of 0.05, we cannot discount the incorrect supposition. This claims that the combined effect of screen time and time spent on social media does not have a substantial consequence on rest quality based on the facts supplied.

A relapse and relationship investigation set up a show to evaluate the affiliation between Screen on Time, Time Went through on social media, and Mental Fatigue. The coming

about condition is:

$$\begin{aligned} \text{Mental Fatigue} = & 4.944 - 0.221 \times (\text{Screen on Time}) \\ & - 0.129 \times (\text{Time Spent on Social Media}) \end{aligned} \quad (1)$$

In this demonstration, Screen on Time and Time Went through social media are autonomous factors, whereas Mental Weakness serves as the subordinate variable. The captured speaks to the trend mental weakness level when both components are truant. The negative coefficients for screen time ($B = -0.221$) and social media utilize ($B = -0.129$) demonstrate that higher screen and social media utilization are related with lower mental weakness in this populace, opposite to common convictions.

The demonstration provides a dependable quantitative apparatus for foreseeing mental weariness and clarifies a significant extent of its change, as evidenced by solid F-statistic and critical p-values within the ANOVA test. This serves as a valuable establishment for advanced thinkers about cognitive suggestions of computerized gadget utilization, with potential applications in mental wellbeing and instructive interventions.

V. DISCUSSION

The study shows a clear relationship between the use of digital devices and human brain and behaviors especially for students at university and same level. In show up despise toward of the reality that reasonability did not expect propensity, comes generally suggest that computerized utilization makes subordinate behaviors. The wrangle around as well emphasizes the influence on mental victory, with extended social media utility related to lifted uneasiness and hopeless, invalidating needs of moved forward social affiliations. Other than computerized contraption utilization, particularly one or two times as of late rest, decreases increase and discouraged signs. The inquiry around offer help highlights that computerized substance presentation antagonistically impacts scrutinizing comprehension isolated to standard bunches. At long last, it raises concerns concerning long-term cognitive changes, such as changes in white and gray matter, particularly in more enthusiastic people. These encounters show up the inquiry for empower examination to assist the unfavorable comes around of advanced contraption utilization.

VI. CONCLUSION

In conclusion, we can have a brief understanding about a strong relationship between computerized gadget usage and behavioral, cognitive, and mental wellbeing results. Over

the top screen time is connected to diminished efficiency, disabled memory, and reduced center. Also, it unequivocally predicts addictive behaviors, emphasizing the need to address compulsive computerized media use. To moderate these negative impacts, techniques advancing careful computerized engagement, mindful utilization, and rest cleanliness are basic. Collaboration between teachers, guardians, and policymakers is critical to implementing approaches that support adjusted computerized utilization. Encourage inquiry is required to investigate the long-term impacts on brain wellbeing and cognitive work. This ponder highlights the requirement for evidence-based interventions to cultivate more advantageous advanced propensities and guarantee cognitive and mental versatility.

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