THE DOPAMINE DILEMMA

An Exploratory Analysis of How Compulsive Screen Time Rewires the Modern Teenage Brain

Shaik Mohammed Kaif
GITAM Deemed To Be University
Bengaluru

TABLE OF CONTENTS

01. Problem Statement 03

02. Methodology 04

03. Data Insights 05-07

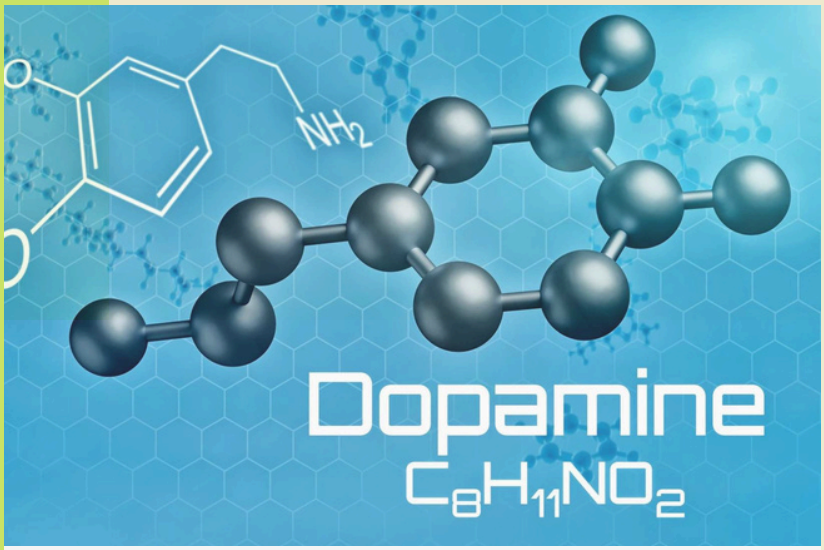
04. Key Takeaways 08-09

05. Tools Utilized 10

06. Conclusion 11

07. References 12

PROBLEM STATEMENT



This project addresses the question: When does healthy usage transform into **harmful dependency?** By analyzing real-world data on teen phone usage, we aim to uncover the patterns that indicate **rising addiction levels and their impact on sleep, academics, and lifestyle.**

The Issue at Hand

In today's world, smartphones have become an **inseparable part of teenage life.** While they bring enormous benefits such as access to information, social connection, and learning tools, **they also pose hidden risks**. The growing concern is that excessive and uncontrolled phone usage is gradually shaping into a form of **behavioral addiction** among teens.

METHODOLOGY

To dissect the complexities of teen phone usage, a systematic **Exploratory Data Analysis (EDA)** was employed using **Python** with the **Pandas library** for **data manipulation** and **Matplotlib/Seaborn** for **visualization.** The process was meticulously structured to ensure robust and reliable findings:

- **Data Preprocessing:** The initial phase involved rigorous data cleaning, which included handling missing values and standardizing formats to create a reliable foundation for analysis.
- **Statistical Analysis:** A hybrid approach combining visual and numerical analysis provided a comprehensive view. We conducted both univariate and bivariate analyses to understand individual variables and their interactions.
- **Visualization & Modeling:** Key relationships were visualized using a suite of plots, including scatterplots, box plots, and bar charts, to identify trends. Furthermore, regression models were developed to statistically quantify the strength of correlations between variables such as daily screen time, phone checks per day, and addiction levels. This dual approach allowed us to not only see the patterns but also measure their significance.

DATA INSIGHTS

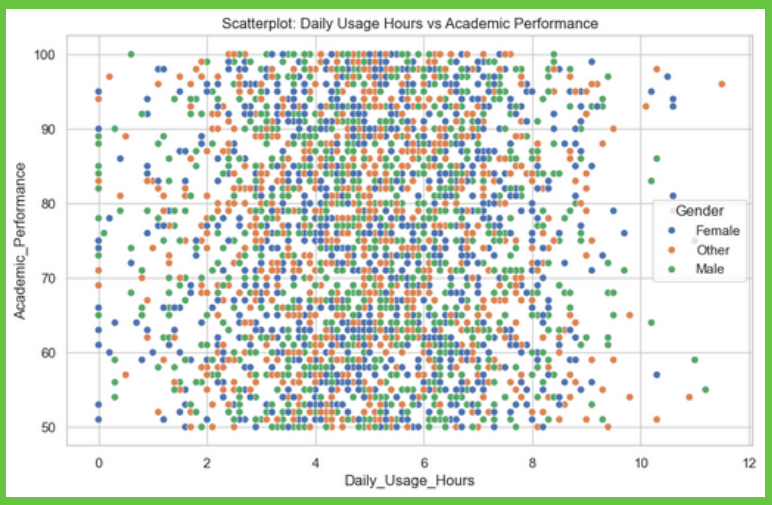
The analysis unearthed several critical insights into the nature of teen digital dependency:

- **The Academic Trade-Off:** A strong negative correlation was observed between daily phone usage and academic performance. As screen time increased, academic scores consistently declined, suggesting a direct trade-off between digital connectivity and educational focus.

- **Sleep Disruption:** Higher phone engagement, particularly before bedtime, was directly linked to reduced average sleep hours. This highlights the disruptive impact of screen time on teens' natural sleep cycles, which is crucial for cognitive function and well-being.

- **The "Why" Matters Most:** The purpose of phone use is a powerful predictor of addiction. Usage centered around social media and gaming was consistently associated with the highest addiction levels. In contrast, educational or communication-focused activities posed a significantly lower risk.

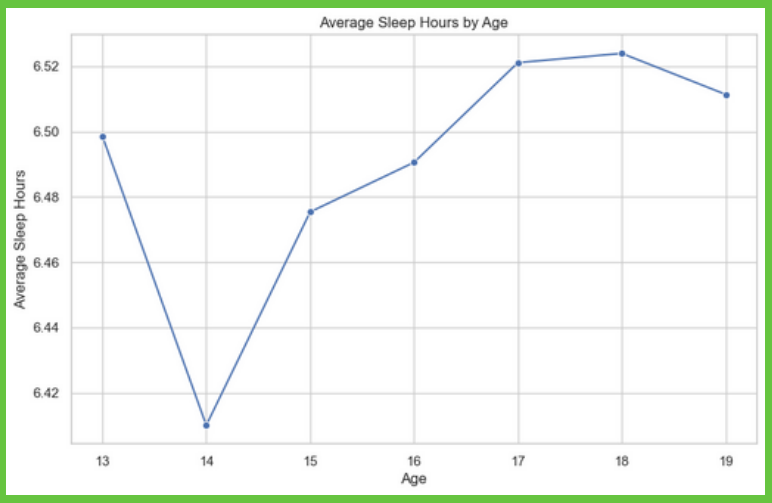
- **Behavioral Ticks:** The frequency of "phone checks" per day emerged as a stronger indicator of addiction than total screen time alone. This compulsive behavior signifies a deeper level of dependency.



More hours = lower scores. A digital trade-off between connectivity and productivity.

Scatter Plot
(Daily Usage vs Academic Performance):

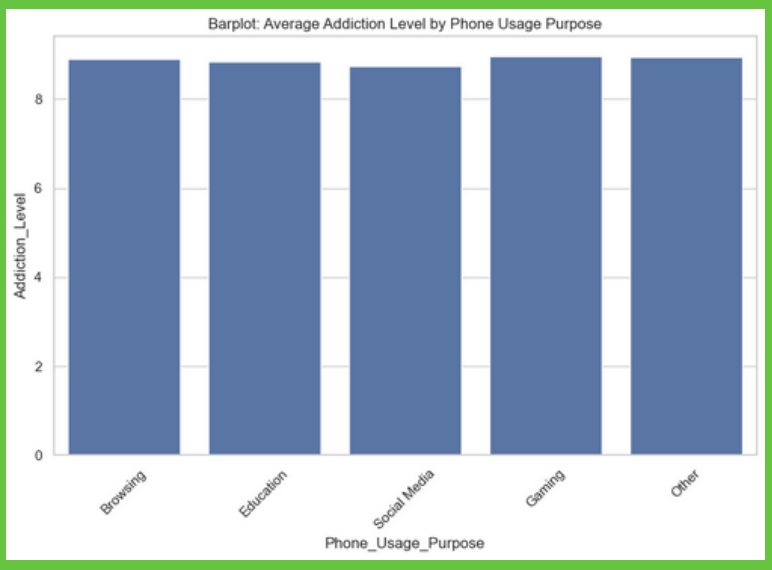
As daily phone usage increases, academic performance shows a noticeable decline. This trend highlights the negative academic impact of excessive screen time.



Digital fatigue isn't about age, but habits. Poor sleep translates into lower energy and academic struggles.

Line Plot
(Age vs Sleep Hours):

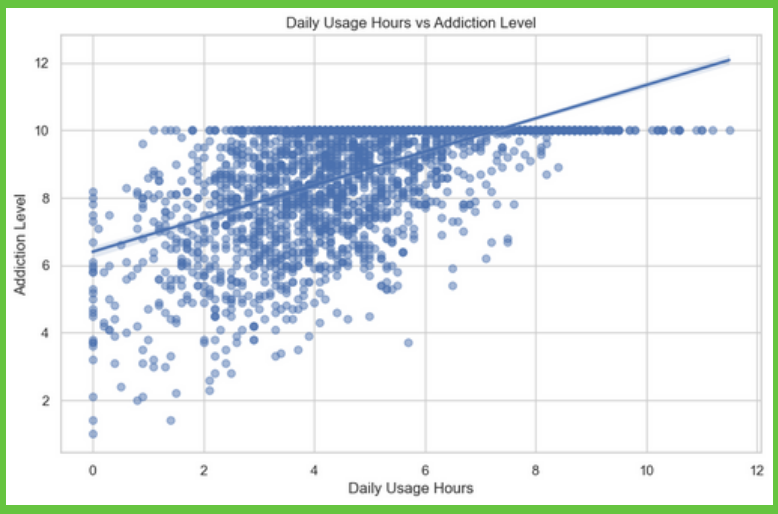
Younger teens tend to get more sleep compared to older ones, but higher phone usage is consistently linked with reduced sleep hours across age groups.



Social media and gaming were the strongest contributors to higher addiction, while educational usage showed much lower risk.

Bar Plot
(Purpose of Phone Usage vs Addiction Level):

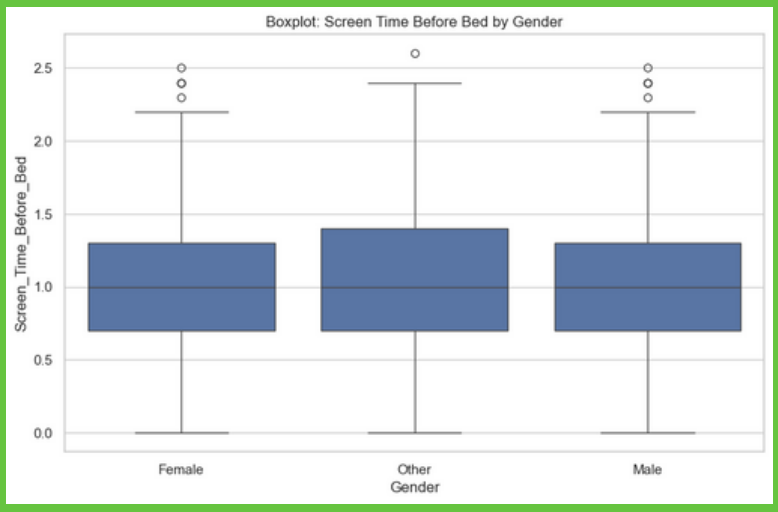
Teens using phones mainly for social media and gaming show higher addiction levels, while those using phones for educational purposes have the lowest addiction risk.



Longer daily screen time strongly raises addiction levels. Extended usage builds unhealthy digital habits.

Regression Plot (Daily Usage Hours vs Addiction Level):

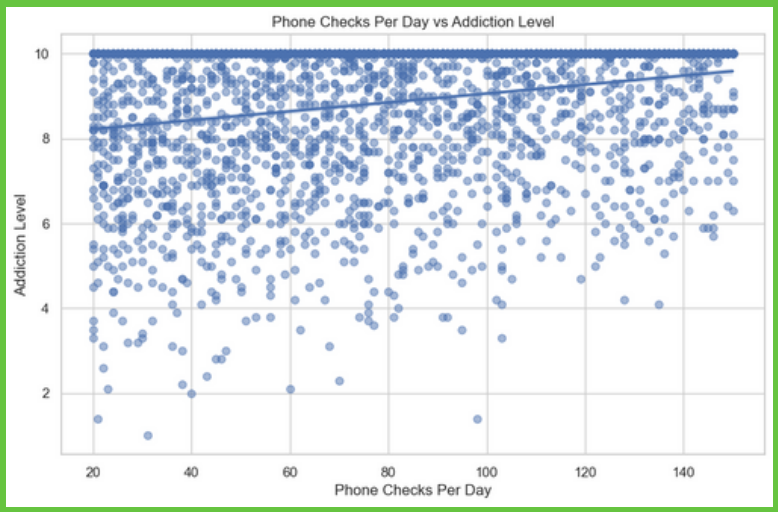
Longer daily usage strongly correlates with higher addiction levels, showing time spent is a major predictor of phone dependence.



Nightly Digital Habits: A Comparative Look at Bedtime Screen Use Across Genders.

Boxplot (Screen Time Before Bed by Gender):

While the median screen time is similar for both genders, boys show a wider range of usage. This indicates that a larger proportion of boys engage in prolonged screen use just before sleeping.



Frequent phone checking is a clear sign of addiction. The habit reinforces compulsive phone use.

Regression Plot (Phone Checks per Day vs Addiction Level):

Frequent phone checks throughout the day are tightly linked with elevated addiction scores, reflecting compulsive usage behavior.

KEY TAKEAWAYS

This analysis delivers several actionable takeaways that paint a clear picture of teen digital behavior:

- **It's Habit, Not Just Hours:** Addiction is less about the total hours logged and more about the underlying habits. Frequent phone checks and a high number of apps used daily are the strongest predictors of dependency, pointing to a pattern of compulsive, fragmented attention.

- **Performance is at Risk:** The link between excessive screen time and lower academic performance is undeniable. Each additional hour of non-educational screen time can be correlated with a measurable dip in grades, impacting long-term opportunities.

- **The High-Risk Activities:** Social media and gaming apps are engineered to maximize engagement through intermittent rewards, creating a powerful dopamine loop that drives addictive behavior more aggressively than other types of phone use.

- **Sleep is a Major Casualty:** Increased phone usage directly corresponds to decreased sleep duration and quality. The blue light from screens suppresses melatonin, making it harder for teens to fall asleep and achieve restorative rest.

- **Gender-Specific Patterns Emerge:** Boys were found to spend slightly more time on their screens before bed. This insight is crucial for tailoring guidance and digital wellness strategies effectively for different genders.

*In short, **it's not just the hours that matter — it's the habit patterns.** This makes awareness and balanced usage crucial in helping teens maintain healthier digital lifestyles.*

TOOLS UTILIZED

To conduct this analysis, I relied on a combination of data science libraries, visualization tools, and programming techniques. These tools allowed me to **clean the dataset, explore hidden trends, and create compelling visualizations** that bring the findings to life.

- **Python** – Data cleaning, analysis, and statistical exploration
- **Pandas & NumPy** – Handling and transforming raw data efficiently
- **Matplotlib & Seaborn** – Building insightful visualizations and correlation maps
- **Jupyter Notebook** – Interactive coding and structured reporting environment
- **GitHub** – Version control and open sharing of my project

CONCLUSION

This project's analysis provides a clear and compelling window into the complex world of teenage phone usage and its consequences. Moving beyond simple screen time metrics, the data uncovers behaviors and patterns that signal a shift from healthy use to harmful dependency. Findings show that as daily screen time increases, crucial aspects of an adolescent's life, such as academic performance and sleep quality, are negatively impacted. This creates a direct trade-off where increased digital connectivity often comes at the cost of educational focus and physical well-being.

Furthermore, the investigation highlights a key insight:
The purpose of phone use is a strong predictor of addiction. Activities like social media and gaming drive more compulsive behavior compared to educational or communicative use. This distinction shows that not all screen time is created equal. Another important finding is that digital addiction is not solely determined by hours spent on a device. Instead, behavioral patterns, such as frequent phone checking, are stronger indicators of dependency, reflecting a deeper, more ingrained habit central to modern digital addiction.

These results highlight the need for a smarter approach to managing teen technology use. Instead of strict time limits, the focus should be on awareness and balanced habits, helping teens use technology as a tool for growth rather than a source of dependency.

REFERENCES

1. Dataset

Teen Phone Addiction Dataset (primary source for all analysis and insights).

texthttps://www.kaggle.com/datasets/khushikyad001/teen-phone-addiction-and-lifestyle-survey

2. Research Papers

1.The Influence of Smartphones on Adolescent Sleep: A Systematic Literature Review
https://pubmed.ncbi.nlm.nih.gov/37092482/

2.Mobile Social Media Usage and Academic Performance
https://arxiv.org/pdf/2004.01392

3. GitHub

Teen Phone Addiction EDA

https://github.com/kaif014/Teen_Phone_Addiction_EDA/tree/main