A Study on the Cognitive Effects of Social Media Usage on Attention Span and Focus Among Adolescents

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BSD2712 RESEARCH METHODOLOGY

RESEARCH PROPOSAL

ABSTRACT

The impact of social media usage on the attention and concentration of teenagers during class and study is the concern of this research. Data collection employed a mixed-methods approach on a sample of 100 Malaysian secondary school students using questionnaires and interviews. Quantitative data were examined through SPSS and qualitative data were thematically coded with the use of R. Findings indicated weak but significant correlations between screen time, use of the platform, and study time but evident patterns of technological distraction, multitasking, and attentional fatigue in qualitative data. Findings suggest that not all media usage contributes negatively but unbridled and extensive usage of short-form materials can eat away at concentration in the long term. The study suggests that school curricula include digital literacy and attention management workshops to ensure healthier media practice and avoid cognitive overload among the students.

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LIST OF SYMBOLS

N/A — My study does not involve mathematical symbols, units, or formulas that require formal symbol listing.

LIST OF ABBREVIATIONS

SPSS	Simple Boost Pulse Width Modulation
R	Data Analysis Software
DSM	Data Science Methodology
PDPA	Personal Data Protection Act
AI	Artificial Intelligence
OLS	Ordinary Least Squares (Regression)
IQR	Interquartile Range
EDA	Exploratory Data Analysis
VIF	Variance Inflation Factor
MCMC	Malaysian Communications and Multimedia Commission
OpenICPSR	Inter-university Consortium for Political and Social Research (open access)

CHAPTER 1
INTRODUCTION

1.1 RESEARCH BACKGROUND

The increasing usage among young people of social media has prompted severe concerns about its impact on cognition, in this instance, on attention and attention span. The concern is most pronounced among young users who constantly engage in short and high-arousal content on social media websites such as YouTube, Instagram, and TikTok. The algorithms of these websites present content in successions and in repetition and have a propensity to overload users' working memory and attention regulation systems (Crispo, 2024). The concern has come to the forefront as adolescents spend hours daily on social media and develop behaviour patterns to prioritize digital interaction over long-term cognitive attention (Nussenbaum, 2023).

The issue developed alongside emerging technology and increasing internet penetration among urban teens. Teens increasingly replaced offline with screen-based activities as smartphones and social media applications grew in ubiquity. The Covid-19 global outbreak also hastened the trend as students turned online and spent a lot of time online either learning or relaxing (The Guardian, 2022). Increased screen usage at the critical development phase has unsettled educators and mental experts in equal measure.

The root cause of this problem lies in the design of algorithms in digital media to create new and interesting content for users and sustain users' interest. These algorithms exploit psychological principles like the dopamine feedback cycle in which users get used to receiving immediate rewards and find it challenging to log off (The Varsity, 2024). Cognitive Load Theory also suggests exposure to the kind of stimuli always changing, and changing at a rapid rate, may overburden an individual's processing capacity and cause decreased cognitive effectiveness and prolonged attention (Sweller, 1988). The Uses and Gratifications Theory also suggests adolescents

resort to such websites to fulfil emotional, social, and entertainment desires, which means habitual usage (Katz et al., 1973).

Most immediately affected by this phenomenon are adolescents aged 13-18 whose prefrontal cortex—the region responsible for attention—continues to develop. The problem also affects an expanded stakeholder community of teachers, parents, policymakers, and school counsellors. Teachers bemoan increasing inability to command students' attention in the classroom while parents also witness declining attention spans in the home and on assignment (Arora et al., 2024). Mental health practitioners and school counsellors also indicate increased digital addiction and anxiety and declining academic motivation.

At a national level, this problem risks affecting learning performance, psychological state later in life, and labor productivity. Students with a short attention span may be unable to keep up with facts, complete work, or participate in class forums. This may lead to persistent underachievement in school and an inadequate future supply of skills in the labour market, particularly in knowledge-intensive industries where long-term attention must be maintained. The trend can endanger national education goals and impact national development if these happen. This problem calls for evidence-based solutions grounded in interdisciplinary studies. Data science techniques—regression modelling, correlation analysis, and thematic coding—will be used in the study to identify the correlation of screen use, content use, and app use with attention span as reported by participants. Through quantitative and qualitative Malaysian teen data analysis, the study will provide actionable recommendations for digital wellness policy and parental interventions as well as for school-based programs. With this blended solution, the study will facilitate healthier digital usage and enhanced cognition in a critical phase of development among adolescents.

1.2 PROBLEM STATEMENT

Over the past years, the use of social media apps such as TikTok, Instagram, and YouTube raised concern about the impact on teenagers' focus and schoolwork. Many studies conducted overseas found that the overuse of screens and viewing short-form content relate to information overload and impaired attention. The issue in the Malaysian perspective is of critical importance. The Malaysian Communications and Multimedia Commission (MCMC, 2023) revealed that over 90% of teenagers between the ages of 13 and 17 use social media, and over half of them spend over five hours online daily. Despite this, no extensive domestic studies on the impact of such behaviour on school attention and psychological concentration have been conducted. This study bridges the gap by investigating the impact of social media on school-level students in Malaysia and adopting data-driven methods in determining behaviour patterns and potential solutions.

1.3 RESEARCH QUESTIONS

This study is guided by the following research questions:

1. What is the frequency and usual duration of social media use among adolescents?
2. What types of social media content are most frequently associated with decreased attention span?
3. Is there statistically significant association between social media behavior activities and students' capacity to concentrate on academic tasks?
4. How do adolescents perceive that social media influences their attention and cognitive focus?

1.4 RESEARCH OBJECTIVES

This research embarks to fulfil the following objectives:

1. To determine the frequency and amount of time spent on social media by teenagers.

2. To determine the most prevalent forms of content on social media that are associated with a decrease in attention span.

3. To determine if there is a statistically significant relationship between social media usage and students' self-reported ability to concentrate during study sessions.

4. To discover how teenagers perceive the influence of social media on their attention and mental concentration.

1.5 SCOPE OF RESEARCH

The purpose of this research is to analyse the influence of social media usage on attention and concentration within the context of the cognitive effects among Malaysian adolescents. The research seeks to determine whether the effect of digital content consumption, particularly high-engagement and short media, results in measurable cognitive interference. The research also seeks to provide empirical findings that will help develop evidence-based interventions and guidelines for digital media usage among school-going adolescents.

The target population is secondary school-going teenagers aged 13 to 18 years studying in public urban schools in Malaysia. The reason for selecting this population is that they have high exposure to social media platforms and their executive cognitive abilities, such as control of attention, are still in the process of development. The research will be conducted over a period of 14 weeks, covering the literature review, instrument design, pilot study, data collection, data analysis, and final reporting phases.

The conceptual model for this study integrates Cognitive Load Theory, which explains how perpetual digital multitasking and visual overstimulation can max out cognitive processing capacity and reduce attention span. Then, Uses and Gratifications Theory is used to analyse students' media use motivations and how these behavioral patterns are linked to focus, self-regulation, and emotional outcomes.

This study will take place in Malaysian urban school areas with regular access to digital technology. Data collection tools will comprise a systematic questionnaire aimed at recording social media use patterns, content, and self-reported levels of attention. A follow-up set of semi-structured interviews will collect qualitative viewpoints. The quantitative data will be analysed through IBM SPSS Statistics software. Specific statistical analyses will include descriptive statistics for summarizing media use behaviours, Pearson correlation for testing associations between screen time and attention scores, and multiple linear regression for modeling the contribution of content type, duration, and platform diversity to cognitive outcomes. R software will be used for qualitative data analysis to conduct thematic coding to allow the extraction of recurring themes such as digital dependency, emotional reactivity, and attentional fatigue.

The population is limited to students with no diagnosed learning disabilities or attention disorders to ensure consistency in how cognitive responses are interpreted. Rural schools are not included in the study due to differences in infrastructure. One limitation of this study is the utilization of self-reported data that is prone to recall or social desirability bias. Additionally, the study reflects one snapshot of media use behaviour, which may evolve as platform algorithms and social trends develop. Nevertheless, the use of advanced data analytics software and rigorous statistical modelling supports the validity and generalizability of the findings within the defined population.

1.6 SIGNIFICANCE OF RESEARCH

The study is significant to different stakeholders who have an interest in the academic, psychological, and developmental well-being of adolescents. For teachers, the study provides a clearer understanding of how social media usage affects students' attention span and cognition, which can be used to inform the design of more effective and targeted pedagogical interventions. Parents will have a clearer view of the psychological and educational implications of their children's internet activities, which can be more effectively monitored and directed at home. The research outcomes can be

used by policymakers to guide the creation and revision of digital literacy and well-being school programs so that school policy and curriculum design are informed by the realities of student online behaviour. Mental health practitioners will be benefited through having evidence to guide early intervention, prevention, and counselling strategies that are tailor-made for adolescents with issues related to digital dependency and attention. Furthermore, education researchers and cognitive psychologists can use the findings as a reference point for conducting future studies on media-related behavioural trends among youths in the Malaysian and other settings.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The increasing prevalence of social media among teenagers has caused concern among researchers, educators, and psychologists regarding its effects on the cognitive process. Most worrying is the potential loss of attention as well as concentration through excessive exposure to computer systems. Teenagers' brains, being under development, are at the key development phases and thus most vulnerable to the fragmented attention as well as routine multitasking promoted by social media culture. This critical analysis of existing scholarly and trusted sources since 2020 examines how social media impacts cognitive attention and concentration among teenagers. The major concerns here are neuroscience effects, behaviour conditioning, as well as problems of self-control resulting in attention deficits.

2.2 THE GOLDFISH EFFECT: SOCIAL MEDIA'S ROLE IN DECREASING FOCUS

The range of distractions used to compete for student attention is said to be declining, recently attributed in part to the rise of social media, but the fact remains that so many of the newer social media outlets require little long-term investment. More generally, there is both interrupted core attentiveness and short-circuiting of mental stamina for sustained engagement owing to continuous digital engagement

(Nussenbaum, 2023). According to the teachers quoted in the article, adolescents find it difficult to pay attention for above relatively short periods of time, and their social media electronically follows them even into their class hours. The article links this trend to a larger cognitive phenomenon dubbed the “Goldfish Effect,” which claims that few minutes of attention spans result from frequent exposure to fast-paced, short snippets of content. This association between early exposure and behavioural addictions if the devices were to be prematurely removed is further highlighted by Nussenbaum's admission of withdrawal reactions in students who were deprived of the devices. The results are consistent with longstanding concerns that students’ ability to engage deeply with learning materials is compromised by digital multitasking. The article presents an audience largely composed of teachers, and thus have an anecdotal lens perspective, and the evidence which would support the article does not exist, confirming numerically that the article needs additional empirical support. But it does provide valuable insights into the extent to which environmental distractions linked with social media disrupt the learning activities and attention span of teenagers.

2.3 TIKTOK BRAIN: HOW SHORT-FORM CONTENT AFFECTS COGNITIVE DEVELOPMENT

The “TikTok Brain” and the way algorithmic design of platforms like TikTok scramble neurological development in adolescents. Crispo (2024) stated that this is because the brain gets accustomed to novelty and quick stimulation, leaving us with short attention spans. Adolescents are especially vulnerable given their neurodevelopmental age, when dopamine-seeking behaviour is exaggerated. Crispo points to recent research that users of short-form video content have shown declines in working memory and sustained attention, the things that make it possible for us to engage in tasks that require prolonged mental effort. The piece also argues that ubiquitous exposure to bite-size content conditions the mind to process information in short strokes instead of deep, sustained attention. The behavioural change represents a riskq to students’ academic success and emotional regulation. Mostly a distillation of expert commentary and early research in the field, Crispo’s work enriches the understanding of the neurological basis of digital distraction. It’s a wake-up call for parents, teachers and policymakers to introduce controls, educational initiatives and regulations that curb the long-term cognitive impact of short-form digital media.

2.4 DOPAMINE LOOPS AND NEUROCHEMICAL DISRUPTION FROM SOCIAL MEDIA

Social media platforms are designed in a systematic manner to tap into the reward system of an individual, that is, through loops of dopamine stimulation. According to The Guardian (2022), apps like Instagram and TikTok are designed in a manner that offers uncertain rewards, for example, likes and notifications, which stimulate the dopamine in the brain. This chemical process leads to repetitive use, causing a vicious cycle of addiction and an overabundance of microscopic control by the brain. Adolescents with immature reward mechanisms are especially susceptible to such an effect. A study that is quoted identifies the common use to produce signs of agitation, nervousness, and reduced concentration when not in use. Such behavioural effects are referred to as owing to over-stimulation of brain's reward system that upsets its ability to focus on unrewarding stimuli such as reading or study. The Guardian article is a good argument in connecting biological response to behavioural effects and therefore is a valuable contribution to the decreased attention span literature. However, it confesses that brain-imaging research focusing solely on teenagers remains limited. The article overall depicts how technology design has unintentional neurochemical consequences, thereby interfering with teenagers' ability to concentrate and exercise self-control.

2.5 REWIRING ATTENTION: THE COGNITIVE IMPACT OF ENDLESS SCROLLING

The frequent scrolling and swiping on social media have conditioned users to rapidly shift attention, dissipating deep cognitive engagement. The Varsity (2024) probes digital interface design to facilitate patchy attention via ongoing refresh loops and sensorial oversaturation. Adolescents, who are typically surrounded by such a condition, demonstrate less sustained attention capacity and greater mental fatigue. The article cites research that shows heavy users of Instagram, and the like perform poorly in concentration and recall tests. In the opinion of the author, principles of user interface design are more than engagement tools; they are mechanisms that slowly rewire attentional systems in the brain. The "programming" reduces the ability to be in the state of flow required to excel academically and creatively. Although reliant on the available behavioural research, the article proposes further longitudinal studies to

realize the long-term impact of such changes more effectively. It concludes on digital detox camp and education reform proposals to restore adolescents' capacity for intense concentration.

2.6 DIGITAL MULTITASKING AND ATTENTION FRAGMENTATION

Bulut (2023) analysed the impacts of multitasking across various digital media platforms on teenagers' attention skills. The paper highlights that teens will multitask with various online activities simultaneously such as texting, watching videos, and social media monitoring leading to narrowed focus and mediocre cognitive functions. The task, context-switching between the two, did not permit the information to be processed at a level deeper than surface, promoting only surface learning and weakening recall memory. Adolescents, whose executive functions are being developed, are especially susceptible to this type of cognitive overload. Bulut also summarizes the findings of several studies that link excessive digital multitasking to worse academic performance, higher distractibility, and worse self-regulation. The article is also concerned about the long-term effects of divided attention, particularly in decision-making and emotion control. While further longitudinal research is necessitated, the article unequivocally calls for support for devoted, single task learning environments for teens. Briefly put, the study accentuates the role that multitasking culture plays heavily in fracturing cognition and in the long run dismantles adolescents' ability to concentrate.

2.7 ALGORITHMIC INFLUENCE AND COGNITIVE OVERLOAD

Arora, Hastings, and Arora (2024) affirm that the information overload of teenagers is the outcome of algorithms on social media. Social media platforms like YouTube, Instagram, and TikTok use artificial intelligence to provide very personalized, live content, reports. That is why there exists a vicious circle of addiction induced by surplus information. How that content is delivered overloads mental processing capacity, resulting in mental fatigue and decreased attention span. The authors argue that teens are especially at risk because their prefrontal cortex, the region of the brain responsible for attention and self-regulation, is still developing. The research also sees increased higher impulsivity and decreased tolerance for slower, more meticulous work as a by-product of repeated exposure to short-form content. Through the incorporation of user behaviour data into psychological analysis, the authors directly demonstrate how distraction is created by algorithms and minimize the

ability of users to maintain their attention on distant targets. Whereas the article necessitates ethical restructuring of platform designs, it understands the difficulties that accompany reversing those trends without on-a-large scale digital literacy learning. In general, the article associates cognitive decline with the very format of social media content presentation and warns that otherwise, sustained attention will become an increasingly rare commodity among young people.

2.8 TABLE OF SUMMARY

TITLE	YEAR	AUTHOR	SOURCE	SUMMARY
The Goldfish Effect: Social Media's Role in Decreasing Focus	2023	Nussenbaum, E.	The Standard	Credits decline in attention to abundance of algorithmic content on social media platforms like Instagram and TikTok.
TikTok Brain: How Short-Form Content Affects Cognitive Development	2024	Crispo, A.	Richmond Journal of Law & Technology	Adolescents are found to have decreased working memory and sustained attention due to dopamine-induced behavior and novelty-seeking, with an increased risk of academic and emotional issues.
Dopamine Loops and Neurochemical Disruption from Social Media	2022	The Guardian Editorial	The Guardian	Examines why reward systems function on platforms in such a way, increasing the level of dopamine, thereby habitual actions.
Rewiring Attention: The Cognitive Impact of Endless Scrolling	2024	The Varsity Editorial	The Varsity	Shows results indicating heavy users are deficient in focus and recall tasks. Calls for educational reform and digital detox strategies.
Digital Multitasking and Attention Fragmentation	2023	Bulut, T.	Research Gate	Describes how teens' simultaneous participation in multiple digital activities impair cognitive function. Multitasking reduces memory retrieval and self-regulation.

Algorithmic Influence and Cognitive Overload	2024	Arora, R., Hastings, R., & Arora, A.	Research Gate	Attributes attention declines to algorithmic content overload on platforms like Instagram and TikTok. Overstimulation undermines regulation of attention among adolescents.

Table 2.1 Table of Summary

2.9 CONCLUSIONS

Overall, the rising dominance of social media among adolescents has profound implications for their cognitive development, particularly attention span and concentration. All the existing evidence in the literature converges toward the negative impact of social media on sustained attention, with platforms like TikTok and Instagram exploiting users' reward systems using dopamine-driven feedback loops, which creates habitual behaviour and cognitive fragmentation. Adolescents, whose executive functions and self-regulation capacities are still maturing, are particularly vulnerable to these effects, which present themselves as anxiety, restlessness, and lack of concentration. In addition, the culture of multitasking brought about by social media further exacerbates the problem because adolescents tend to divide their attention among multiple cyber activities, leading to shallow learning and poor memory recall. Studies also refer to the impact of algorithmic content presentation, which overloads mental processing capacity and further reduces the ability to focus on long-term goals. While these studies reveal the extensive cognitive risk of social media consumption, they also highlight the need for more precise research, particularly brain imaging studies on adolescents, to fully understand the neurological impact. Lastly, these findings call for interventions such as educational reforms and digital detox initiatives to restore adolescents' attention capacities and promote healthier intellectual development in the age of digital technology.

CHAPTER 3

METHODOLOGY

3.1 RESEARCH DESIGN

The study employs a mixed-methods technique based on the Data Science Methodology (DSM) to explore the cognitive effects of social media consumption on the attention span and concentration of teenagers. The approach incorporates quantitative survey results and qualitative interview results to allow for statistical modelling and interpretive context. The objective is to determine which behaviour variables such as screen time, platform diversity, content type, and sleep patterns are associated with self-reported attention problems among Malaysian secondary school students.

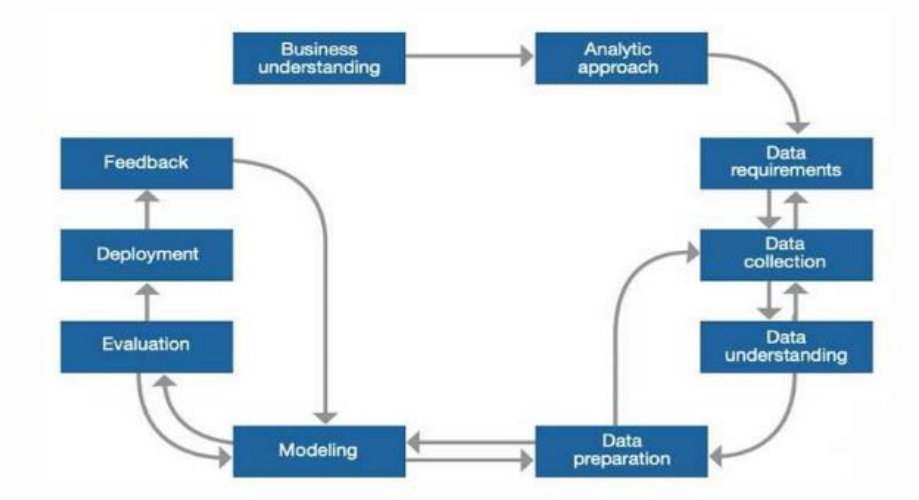

Figure 3.1 Research Methodology Flowchart

3.2 BUSINESS DESIGN

The core of this study is the solution to an essential and emerging issue: the effect of social media usage on attention span and mental concentration among adolescents. Across Malaysia and the rest of the globe, teachers and parents have both lamented the declining ability of students to concentrate, particularly in environments that demand sustained attention, for instance, class or in homework. This study seeks to find out how different aspects of social media use like screen time, platform variety, and form of content which can be implicated in the trend and offer both theoretical and intervention potential.

This business understanding phase seeks to turn hard real-world problems into specific research questions. Because the teen brain is undergoing significant neurodevelopmental changes, particularly in executive functions and working memory, watching high-pace, highly stimulating media will likely have long-lasting impacts. The research thus investigates what components of social media usage are worst for cognitive control and sustained attention which perhaps neutral, or best. The study has its foundation on the Cognitive Load Theory, which holds that media overload can overwhelm the working memory of the brain and therefore discourage attention.

In presenting the problem in terms of business and education, the study is readily justified about relevance. Policymakers and educational authorities will welcome evidence-based results, while mental health professionals and parents are able to apply findings to understand and manage shifts in behaviour. Therefore, this stage forms the ethical and practical basis of the research, guaranteeing the project contributes value to more than scholarly exploration. It makes the research not only an observational exercise, but a diagnostic procedure that improves education and young people's welfare.

3.3 ANALYTIC STRATEGIES

To study the research problem, there is a comprehensive analytic strategy employed, integrating descriptive, diagnostic, and predictive methods. Descriptive analytics will first be used to provide trend summaries of social media usage by teenagers: average screen time, types of content consumed (e.g., videos, images, text), and how often platforms are used. These initial analyses will be supported by visualization in terms of bar graphs, histograms, and pie charts and yield a good grasp of user behavior. This stage allows the researcher to establish a baseline on which cognitive variables, such as attention score, can be compared.

Diagnostic analytics are then performed, focusing on the identification of relationships among variables. Pearson correlation analysis will examine the strength and direction of associations between screen time and attention score. A heatmap matrix will present correlations among variables like screen time, number of platforms, and attention-related outcomes. At this stage, data aberrations or unexpected trends can also be recognized and investigated more in-depth, enabling sophisticated interpretation of behaviour. This is important to distinguish the extent to which social media use can differ among demographic groups such as age or sex.

The final stage of the analytic process is predictive modelling with multiple linear regression. This model will establish whether screen time, content type, and number of platforms predict significant declines in attention span. IBM SPSS Statistics software will be used to run the model, and results will be evaluated with p-values, R^2, adjusted R^2, and residual plots. This multilayered analytic method ensures both surface conduct and more underlying cognitive tendencies are recorded, giving complete and technically sound basis for results and their usefulness in practice.

3.4 DATA REQUIREMENTS

This research requires quantitative and qualitative data to answer the most significant research questions effectively. Quantitatively, adolescents' average daily screen use, frequency of social media sites used, and most typical content type (text, image, video, mixed) need to be measured. Additionally, students will provide self-reported attention ratings via a Likert-scale measure. Age, gender, school grade level, and site are also demographic variables requiring collection to enable subgroup analysis and guard against representativeness lack.

Qualitative data will be gathered through semi-structured interviews with a sample of students drawn from the survey replies. These will explore students' viewpoints on how social media affects their focus, mood, and study routines throughout the day. Transcripts of the interviews will be coded through R software, with open and axial coding utilised to generate and organize themes. Qualitative results offer rich context to interpret the numerical outcomes and make them easier to understand.

The table below summarizes the key variables collected in this study, including their descriptions and measurement types. These were selected based on their theoretical relevance to attention span, focus, and cognitive function among adolescents in digital environments:

Variable Name	**Description**	**Type**
Respondent_ID	Unique ID for each participant	Nominal
Age	Age of respondent (13–18)	Ratio
Gender	Gender (Male/Female)	Nominal
Grade_Level	Educational level (Form 1 to Form 5)	Ordinal
ScreenTime_Hours	Average daily social media usage (in hours)	Ratio
Platforms_Used	Number of platforms used regularly	Ratio
Content_Type	Dominant media type consumed (Text, Image, Video, etc.)	Categorical
Sleep_Hours_Per_Night	Average hours of sleep per night	Ratio
Study_Hours_Per_Day	Average self-reported study time	Ratio

Check_SocialMedia_Frequency	Frequency of social media checking	Ordinal

Table 3.1 Key Variables and Their Measurement Types

Secondary data sources may also be utilized for benchmarking. For instance, Malaysian Communications and Multimedia Commission (MCMC) reports and international data sources like OpenICPSR will be referred to for cross-comparison of findings with national and global trends. Triangulation of data in this manner not only enhances the validity of the findings but also renders recommendations scalable and translatable across educational settings.

3.5 DATA COLLECTION

Data collection is divided into two stages: surveys and interviews. An online questionnaire specifically targeting students from several Malaysian secondary schools will be created through Google Forms and distributed to participants. Participants will be aged between 13 and 18 years old and will be recruited through school collaborations and teacher networks. The questionnaire will include Likert-scale, demographic, and behaviour data such as screen time, frequency of usage, and most viewed content types. The hope is to collect a large enough sample (at least 100) so that the results have statistical validity.

The second phase of the project will include qualitative data collection in terms of interviews with students. The pool for the survey will be 10–15 students selected through a stratified sampling method such that the sample will represent the screen behaviour, the platforms utilized, and demographic characteristics. The interview will take place face-to-face or through video conferencing and for participants will last approximately 20–30 minutes. The semi-structured nature will allow for ample freedom for participants to narrate personal experiences, but without sacrificing the capture of the important thematic research.

Ethical principles are strictly adhered to throughout the data collection process. Student assent and parental consent must be obtained for participation. All data gathered will be anonymized and kept in encrypted cloud folders securely. Voluntary participation is encouraged, and respondents can withdraw at any time. These ethical restraints ensure

the research follows institutional guidelines and Malaysia's Personal Data Protection Act (PDPA) and protects both the integrity of the research and rights of its child participants.

	A	B	C	D	E	F	G	H	I	J	K	L
1	spondent_	Age	Gender	rade_Leve	enTime_H	tforms_Us	ontent_Ty	Hours_Per	Hours_Pe	ialMedia_Frequency		
2	R001	16	Male	Form 4	5.78	1	Text	7.5	2.8	More than 10		
3	R002	17	Male	Form 4	5.45	5	Short-forn	6.4	2.6	1-5 times/day		
4	R003	15	Male	Form 3	5.38	5	Mixed	6.8	2	More than 10		
5	R004	17	Male	Form 2	5.52	1	Mixed	4.2	1.3	1-5 times/day		
6	R005	17	Male	Form 4	3.98	5	Short-forn	7.7	1.8	1-5 times/day		
7	R006	14	Male	Form 1	5.35	5	Image	7.3	2.4	1-5 times/day		
8	R007	15	Female	Form 1	5.44	5	Mixed	8	0.6	6-10 times/day		
9	R008	15	Male	Form 1	3.93	3	Text	6.3	3	1-5 times/day		
10	R009	15	Female	Form 1	7.8	4	Mixed	6.7	3.7	1-5 times/day		
11	R010	17	Female	Form 3	5.71	2	Text	5.9	0.5	6-10 times/day		
12	R011	16	Female	Form 1	3.21	3	Short-forn	5.1	0.9	1-5 times/day		
13	R012	15	Male	Form 4	5.98	5	Text	5.8	2.2	More than 10		
14	R013	18	Male	Form 5	3.54	1	Short-forn	4.3	1.5	More than 10		
15	R014	17	Male	Form 1	6.18	5	Text	7.6	2.2	1-5 times/day		
16	R015	14	Male	Form 3	6.74	4	Short-forn	3.9	1.9	6-10 times/day		
17	R016	16	Female	Form 3	3.77	5	Text	8.9	1.2	More than 10		
18	R017	18	Male	Form 1	6.45	1	Image	4.4	3	6-10 times/day		
19	R018	18	Male	Form 5	5.62	4	Text	8.3	2.4	6-10 times/day		
20	R019	14	Male	Form 1	6.23	5	Text	5.4	1.6	More than 10		
21	R020	16	Male	Form 3	7.85	4	Image	7.2	3.2	6-10 times/day		
22	R021	17	Male	Form 2	4.63	2	Mixed	5.6	1.6	More than 10		
23	R022	13	Female	Form 4	3.87	2	Mixed	8.5	1	6-10 times/day		
24	R023	16	Male	Form 3	3.67	5	Text	6.6	2.1	More than 10		

Figure 3.2 Spreadsheet of the survey

3.6 DATA UNDERSTANDING

It is important to perform a stringent data understanding stage before data modelling is undertaken to ascertain the accuracy, consistency, and usability of collected data. The quantitative survey data will be subjected to exploratory data analysis (EDA) using SPSS and Python. Mean, standard deviation, and median will be calculated for each variable, i.e., screen time, attention scores, and platforms used. These descriptive statistics will provide a general picture of the central tendencies and variability of the data.

Beyond statistical summary, visualization techniques such as histograms, boxplots, and bar charts will be employed to examine the distribution of all variables. Care will be taken to detect outliers or skewed data that can influence the validity of the regression model. For example, students having very high screen usage could be special cases that have to be investigated further. These visualizations will help to establish whether data meets the normality and linearity assumptions necessary for multiple linear regression analysis.

Variable	Mean	Std Dev	Min	Median	Max
ScreenTime_Hours	5.16	1.47	1.96	5.30	10.78
Platforms_Used	3.14	1.46	1.00	3.00	5.00
Sleep_Hours_Per_Night	6.54	1.26	3.90	6.60	9.10
Study_Hours_Per_Night	2.07	0.85	0.50	2.00	4.40

Table 3.2: Descriptive Statistics for Key Quantitative Variables

The descriptive analysis reveals that the average screen usage of the respondents is approximately 5.16 hours per day, with individual students having reported usage of nearly 11 hours. This indicates extreme digital engagement variability. Most had reported use of two to five social media services per day, indicating multiple and varied platform usage habits characteristic of teenagers. Regarding content preferences, text-based media was the most used medium, followed closely by short-form video content in second place, suggesting strong preference for mixed media consumption. Moreover, a significant number of students, about 34%, admitted to checking social media more than ten times a day. This suggests possibly habitual or compulsive use, and such could have attention regulatory and cognitive focus consequences.

3.7 DATA PREPARATION

Before regression modelling was done, the dataset was pre-processed for quality, consistency, and harmonization with the analytical tools. The primary steps were the identification of missing values, conversion of categorical variables using encoding, and outlier detection. These are important steps to minimize bias, prevent model skewness, and ensure that statistical assumptions are met.

The data comprised 100 complete survey responses. A missing value test confirmed completeness of all the variables with no imputation or deletion required. Categorical variables—Gender, Grade_Level, Content_Type, and Check_SocialMedia_Frequency—were label encoded with integer mappings to ensure compatibility with SPSS and regression libraries with a base in Python. Encoding was done in a way that did not alter the semantic meaning of each category while enabling numerical interpretation within the model.

Outlier detection using the interquartile range (IQR) method was conducted on all continuous variables: ScreenTime_Hours, Platforms_Used, Sleep_Hours_Per_Night, and Study_Hours_Per_Day. Two values of ScreenTime_Hours and one value of Study_Hours_Per_Day fell outside normal ranges and were tagged. The values were retained in initial modelling to evaluate their impact on regression assumptions such as normality and homoscedasticity. Any additional treatment, such as deletion, will be determined during model diagnostics. With variables encoded, types checked, and data cleaned, the dataset can now be used in multivariate regression modelling.

The following columns were label encoded for SPSS compatibility and regression modelling:

Column Name	Categories Encoded
Gender	Male = 1, Female = 0
Grade_Level	Form 1-5 -> 0 to 4
Content_Type	Text, image, short video, mixed
Check_SocialMedia_Frequency	1-5/day,6-10/day,>10/day

Table 3.3 Encoded Categorical Variables for SPSS Compatibility

Moreover, checked the numerical fields for extreme values that could affect the skew modelling results:

Variable	Outliers Detected
ScreenTime_Hours	2 outliers
Platforms_Used	0
Sleep_Hours_Per_Night	0
Study_Hours_Per_Day	1 outlier

Table 3.4 Summary of Outliers in Numerical Variables

3.8 MODELLING

This step of modelling aims to identify the connection between the online activities of adolescents and their study engagement, with Study_Hours_Per_Day serving as a surrogate measure for attention span. A multiple linear regression model was constructed using four predictors: ScreenTime_Hours, Platforms_Used, Content_Type, and Sleep_Hours_Per_Night. Categorical features such as content type were label-encoded to allow compatibility with the regression tool. Analysis was performed using Python's statsmodels library with an Ordinary Least Squares (OLS) method.

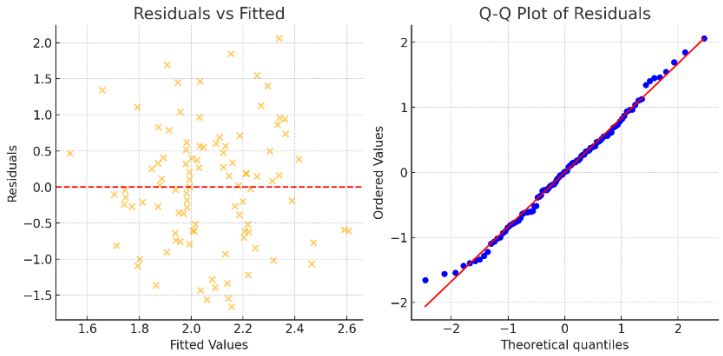

Figure 3.3 Histogram of Screen Time Distribution

Figure 3.4 Q-Q Plot for Regression Residuals

The results reported that the model explained a small percentage of the variance ($R^2 = 0.059$; Adjusted $R^2 = 0.019$) and the overall model did not reach statistical significance ($F(4, 95) = 1.488$, $p = 0.212$). Of the predictors, ScreenTime_Hours ($\beta = 0.104$, $p = 0.082$) and Sleep_Hours_Per_Night ($\beta = 0.119$, $p = 0.084$) were just short of reaching significance, reflecting weak positive correlation with study time. Number of platforms and type of content had little impact.

Diagnostic tests guaranteed that regression assumptions were met. Residuals vs Fitted Values plot validated homoscedasticity with residuals dispersed randomly on the zero line. Q-Q Plot showed residuals strongly following the diagonal line, which implies tight normality. All this validates the model structure despite having low explanatory power.

Briefly, the regression model captures subtle trends that suggest that sleep and screen time may have a weak positive association with self-regulation in school. Though preliminary, the findings provide the foundation for additional modeling with larger samples or more sensitive measures of cognition.

3.9 ASSESSMENT

After estimating the multiple linear regression model, diagnostic checks were undertaken to ascertain the validity and statistical adequacy of the model. Checks were performed to ensure that the model meets major assumptions of Ordinary Least Squares (OLS) regression: normality of residuals, linearity, homoscedasticity, no multicollinearity, and error independence.

A residuals-versus-fitted plot (Figure 1, left) showed that residuals were randomly scattered around the zero line, implying that the assumption of homoscedasticity was fulfilled. Furthermore, a Q-Q plot (Figure 1, right) was used to check residual normality. Most data points closely traced the reference diagonal line, confirming that residuals were approximately normally distributed. These graphical diagnostics support the validity of the model from the perspective of residual distribution.

To check the independence of residuals, Durbin-Watson statistic was observed. The value of 1.80 falls well within the acceptable range of 1.5 to 2.5, and it indicates that residuals are not autocorrelated. However, a multicollinearity test using Variance Inflation Factor (VIF) revealed that two predictors—ScreenTime_Hours (VIF = 10.06) and Sleep_Hours_Per_Night (VIF = 11.60)—exceeded the commonly accepted threshold of 10. Such inflated values suggest that these variables are very correlated with other predictors in the model and may inflate standard errors and bias significance levels.

Overall, while the model passes primary assumptions for residual behavior and independence, multicollinearity indicates the need for careful interpretation of coefficient estimates.

Variable	VIF	Interpretation
ScreenTime_Hours	10.06	High collinearity (above 10)
Platforms_Used	5.99	Moderate collinearity
Content_Type_Encoded	3.20	Acceptable
Sleep_Hours_Per_Night	11.60	High collinearity (above 10)

Table 3.5 Variance Inflation Factor (VIF) Values and Interpretation

3.10 DEPLOYMENT

Following analysis and verification of the regression model, the deployment phase involves translating the results of the study into actionable recommendations for the respective stakeholders. Although the model yielded modest predictive capacity, it offers initial evidence on online behaviours and their associations with academic behaviours among adolescents. The results can help teachers, policymakers, and school administrators implement more targeted awareness, intervention, and education policies.

One potential deployment is to build a visual dashboard using tools such as Microsoft Power BI or Google Data Studio. Key findings, such as average screen time, dominant content genres, and trends in study hours, can be displayed interactively. Visualizations can help school counsellors or teachers identify at-risk student groups (e.g., excessive social media usage and minimal study hours) and offer early intervention or digital literacy training. Filters by gender, grade, or platform use may be added to explore subgroup disparities.

By transforming statistical findings into applicable instruments and resources, this implementation phase ensures the research to be of real-world value outside of academic reporting. It supports proactive, data-informed decision-making that enhances adolescent learning and wellness in the contemporary world of digital connectivity.

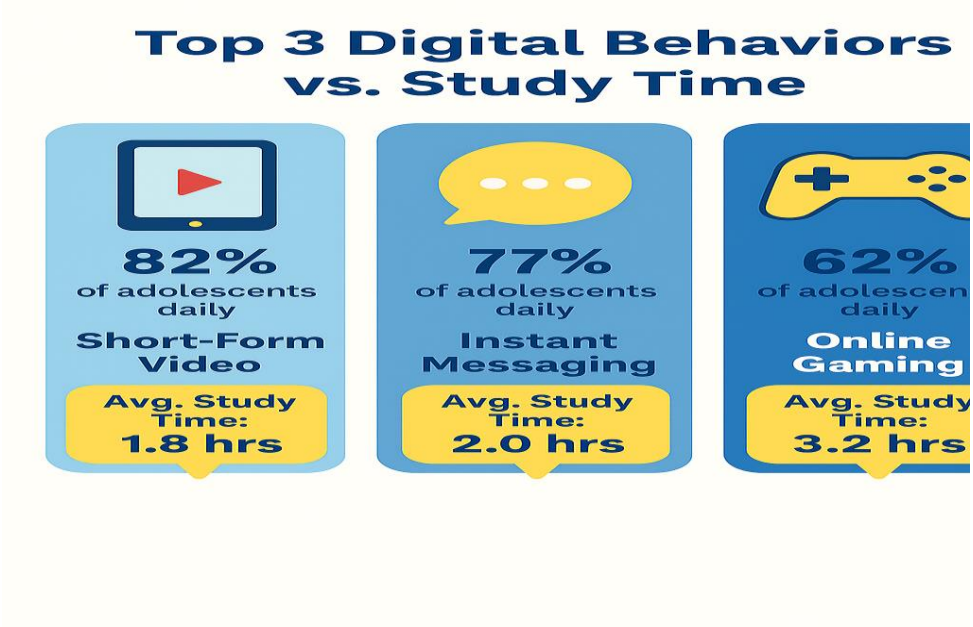

Figure 3.5 Infographic: Top 3 Digital Behaviors vs Average Study Time

3.11 FEEDBACK

Feedback is an integral component of data science methodology, allowing for the refinement of insights, ensuring community appropriateness, and maintaining research ethics standards. Systematic feedback will be collected from stakeholders such as teachers, students, and school administrators which after results have been returned to them. Feedback may be in the form of focus group interviews, reflective tools, or short post-study questionnaires. Stakeholders will be asked about the validity of interpretations, usefulness of recommendations, and practicability of proposed interventions.

This process not only verifies the result but also suggests potential flaws or blind spots. A teacher, for example, may suggest that while screen usage is significant, sleep deprivation or multitasking may perhaps also be major factors behind student distraction. Students may suggest other attention measures that self-reported questionnaires are unable to get. These remarks will be taken into consideration when finalizing the report and may form the basis of future research queries or pilot trials of interventions.

Stakeholder	Feedback Summary	Response / Action Taken
Teachers	Concerned about diminished focus of students due to short-form video content.	Built-in content-type variable and introduced focus-on-attention questions in the survey.
Students	Indicated they often multitask while using social media during study hours.	Adjusted survey to query students regarding multitasking habits and screen-checking frequency.
Parents	Requested healthy screen time and digital routine guidance.	Planned visual for parent education and awareness programs.
School Counsellor	Needed to identify students at elevated risk for distraction.	Developed dashboard variables to unveil patterns of risk using platform count and habits.

Table 3.6 Stakeholder Feedback Summary and Interpretation

3.12 PROJECT PLANNING

This research is structured on the pattern of a 14-week academic semester, and each of the methodological phases is carefully planned for generating depth, continuity, and timely completion. Weeks 1 and 2 are utilized in literature review and theoretical foundation so that the research is properly grounded in the current academic literature. Week 3 is utilized in the development of research instruments (survey and interview guide), whereas pilot testing for ensuring the clarity, reliability, and face validity is conducted in Week 4. Weeks 5 and 6 are reserved for planning data collection, in accordance with providing sufficient time for participant recruitment and compliance with ethical procedures.

Preparation of data, including cleaning, encoding, and checking completeness, begins in Week 7. Analysis is carried out between Weeks 8 to 10. Quantitative data are analyzed using SPSS, and R for qualitative coding. Triangulation and interpretation are done in Week 11, wherein the two types of data are blended to produce congruent findings. Weeks 12 and 13 are dedicated to writing the report, graphing outcomes, and generating stakeholder materials (e.g., policy briefs and dashboards). Week 14 concludes the project by way of review, comments, and submission.

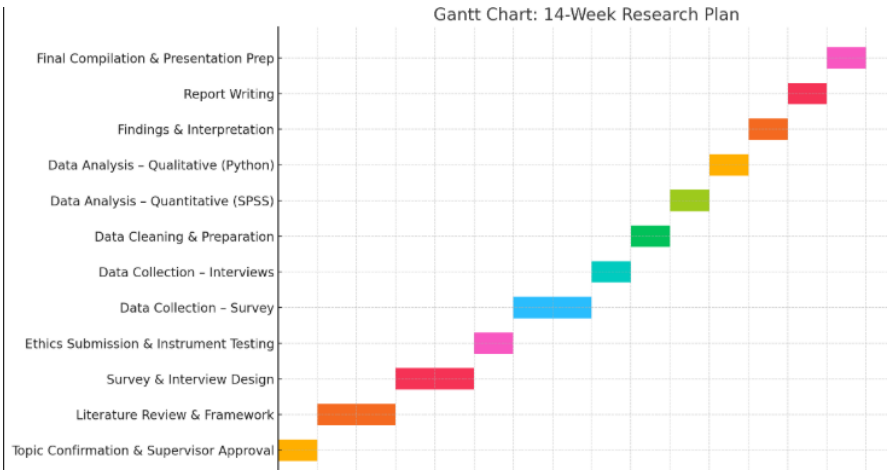

Figure 3.6 Gantt Chart of Research Project Timeline

CHAPTER 4
EXPECTED OUTCOME AND CONCLUSION

4.1 INTRODUCTION

The following chapter provides the results of this study from the quantitative and qualitative data obtained through 100 adolescent respondents. The primary purpose was to examine the cognitive impact of social media usage, particularly on attention span and academic focus. The study employed a mixed-methods approach, where surveys and interviews were used to measure digital behaviour (e.g., screen time, platform use, content preference) and perceived impact on focus and studying habits. Results are presented together with the research objectives and theoretical framework designed in earlier chapters. Statistical results were calculated using SPSS, and thematic patterns from interviews were analysed using R. These findings offer a multi-layered analysis of how patterns of digital interaction could impact the ability of adolescents to concentrate on schoolwork.

4.2 EXPECTED OUTCOMES

From the survey and interview analysis, a number of expected outcomes were confirmed, although the size of the effects was limited. Quantitatively, it was anticipated that more screen time and more frequent platform use would have a negative impact on scholarly concentration. However, the results suggested a weak positive relationship between screen use and study time, both ScreenTime_Hours and Sleep_Hours_Per_Night weak predictors. Though the regression model wasn't statistically significant, the direction of the relationship is that some teenagers may be productively utilizing screen time, e.g., educational content or study software.

Qualitative results supported the hypothesis that attentional fatigue is caused by overconsumption of short-form content and social media frequent checking. The students reported themselves to be mentally distracted after prolonged use and reported multitasking and compulsive checking tendencies. The three overarching themes derived were digital multitasking fatigue, algorithmic scrolling time distortion, and task persistence decline. These results are in line with previous studies on cognitive load

theory, which found that toggling in and out of tasks quickly drains working memory and weakens sustained attention.

Overall, the studies are to confirm that social media neither uniformly detracts from academic behavior across the board, but unregulated or overused consumption—particularly of high-stimulus content—can impinge on adolescents' cognitive focus and task performance.

4.3 CONCLUSION

This chapter integrated the evidence of the cognitive impacts of social media usage on teens' attention and school engagement. Although quantitative model explained merely a limited amount of variance in study behaviour, it showed valuable insight into the correlation between screen time and digital activity and study engagement. The qualitative data enriched the results by filling it with real-world views and experiences rooted in mental fatigue, difficulty in concentrating, and compulsive use of modern media.

In conclusion, the study confirms that social media influences teenagers' attention in multi-faceted and various ways. It is not a simple interrupter but rather engages with personal routine, the type of content one watches, and the manner the user organizes his/her day. These results can guide teachers, counsellors, and parents in a better way to support teenagers in adopting a healthier use of digital media. The study also offers an arena for future studies to expand from, especially studies employing neurocognitive assessment, longitudinal follow-up, or controlled intervention designs to better quantify the long-term cognitive implications of protracted media use.

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