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Screen time and its association to memory retention and concentration among adolescent high school students

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Abstract

This study aims to determine the presence or absence of a correlation between screen time with memory retention and concentration. A quantitative quasi-experimental research design was utilized to assess the students' memory retention and concentration. Fifty-three students were selected using purposive sampling, a non-probability sampling technique. Data were collected using a questionnaire designed to evaluate the amount of screen time, along with performance tasks such as the Rey Auditory Verbal Learning Test to measure memory and the Stroop Test to measure concentration. The participants were found to spend 4.5 times longer on screen time than the recommended amount by the American Academy of Pediatrics. The results showed a negative correlation between the use of smartphones and the scores of the Rey Auditory Verbal Learning Test and the Stroop Test, indicating a negative correlation between screen time to memory retention and concentration. The results further showed that the grade level and gender have no statistical significance to memory retention and concentration. This study confirms that as the smartphone use increases, memory retention and concentration decreases.

Keywords: *smartphone use, cognitive function, attention span, cognitive performance, adolescent health*

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1. Introduction

In the midst of the 21st century, screen time has become one of the most prevalent aspects of an individual's daily life. Studies show that the average person spends approximately 6 hours and 40 minutes each day looking at a screen (Kumar, 2026; Data Reportal, 2023). The number is significantly higher among teenagers aged 12–18, who spend an average of 9 hours per day on screen time. This figure continues to increase at an alarming rate with the emergence of new technologies, raising concerns regarding the potential risks associated with excessive screen time. One of these risks may involve the possible impairment of memory retention and concentration (Oswald et al., 2023; Kaewpradit et al., 2025; Kar et al., 2025; Muppalla et al., 2023; Manwell et al., 2022; Shaleha & Roque, 2025).

Several studies suggest a possible correlation between screen time, memory retention, and concentration (Shalash et al., 2024; Kar et al., 2025; Soares et al., 2021; Muppalla et al., 2023). However, the findings of these studies vary, with some supporting the existence of a significant relationship and others concluding otherwise. For instance, Khan and Khan (2022) suggest that the constant bombardment of information and stimuli causes chronic sensory overstimulation, which in turn results in memory and concentration problems. In contrast, Lodge and Harrison (2019) argue that although excessive technology use may contribute to shrinking attention spans and memory problems, there is still no significant correlation between these factors. Regardless of these differing findings and interpretations, the amount of time individuals spend on screens continues to increase drastically.

A person's concentration and attention span have also declined significantly, with the average attention span decreasing by more than 66% over the past two decades (Oaten, 2024). In addition, constant screen time has been shown to hinder the formation of strong long-term memories during studying (Muppalla et al., 2023). This alarming empirical evidence may prove detrimental to students' academic lives, as neglecting this issue may result not only in declining academic performance but also in reduced concentration during lessons and weaker retention of learned material. This concern is further emphasized by the lack of awareness regarding the possible negative consequences of excessive screen time.

This study aims to determine the relationship between screen time, memory retention, and concentration. The study is primarily significant in the fields of health and education. Screen time has become one of the most prevalent aspects of a student's lifestyle; therefore, it is imperative to understand and examine the effects of prolonged screen time on students' health. Furthermore, the effects of screen time on memory retention and concentration may play a vital role in the learning process of adolescent students. The current study also highlights the importance of memory retention and concentration not only for students' academic performance but also for the holistic improvement of their day-to-day lives.

2. Literature Review

2.1. Memory

Memory retention is defined as "*the ability to remember information over a period of time*. *It is the process of retrieving information after it has been encoded and stored*" (Siu, 2020). Memory retention is important in practically all aspects of human life, from the workplace and school to even basic human functions. The ability to retain certain concepts allows to continuously grow and learn. Retention is also susceptible to decay under certain conditions (Arthur et al., 1998). As such, hampering this ability would negatively affect every aspect of life in which memory plays a role.

Memory can be further classified into different types according to its nature, characteristics, and functions. Researchers agree that there are four general types of memory: sensory memory, short-term memory, working memory, and long-term memory. These categories encompass all forms of memory experienced by humans, and each plays an important role in the retention and recall of information (Ohwovoriole, 2024). Information must first be changed into a usable form before it can properly create new memories. As such, psychologists distinguish five stages in the learning and memory process: encoding, storage, recall, retrieval, and forgetting. Each stage can be affected by different factors, which may influence how well information is remembered (Mujawar et al., 2021).

2.2. Concentration

Concentration refers to the "degree of attentional engagement" (Hughes et al., 2013; Linnell & Caparos, 2013). It forms part of a broader concept called "attention." This broader concept encompasses the overall cognitive process of selecting and focusing on certain stimuli or information in the environment. Concentration specifically refers to the ability to sustain focus. It is fundamental to cognitive functioning and serves as a critical factor in various activities such as problem-solving, working, leisure activities, and studying (Sharpe et al., 2025; Bahri et al., 2026).

According to Avila-Medina (2021), an individual goes through three levels of concentration while focusing on a task: light, moderate, and deep concentration. During a study cycle, the brain progresses through these three levels before achieving the deepest state of concentration. When distractions interfere with an individual's focus and concentration, the brain is forced to move from deep concentration back to light concentration, assuming that the individual reaches the deep concentration phase at all. Regaining deep concentration is much more difficult than entering it in the first place.

2.3. Screen Time

The term "screen time" refers to any activities performed in front of a screen. These activities may include watching television, working on a computer, or using a mobile phone. Activities performed during screen time may vary from casual internet surfing and watching shows to playing mobile games. As such, screen time has become one of the most common leisure activities among children and adults alike (Adelantado-Renau et al., 2019).

Screen time may be classified as either active or passive. Passive screen time refers to viewing screen content that requires no interaction or input from the user. Activities such as watching television may be considered passive screen time. In contrast, active screen time refers to interactive, intentional, and cognitive engagement with a device that provides screen content (Hu et al., 2020). Activities such as using computers or internet-enabled touchscreen devices with interactive feedback based on user input are forms of active screen time.

The term "digital dementia" was coined by German neuroscientist and psychiatrist Manfred Spitzer in 2012. This term describes changes in cognition resulting from the overuse of technology (Ali et al., 2024; Kanbay et al., 2025). Digital dementia refers to cognitive decline and memory problems caused by the excessive use of digital technology. This condition is characterized by symptoms such as forgetfulness, difficulty concentrating, and a decreased ability to focus (Neurocenternj, 2023). It is not a diagnosable health condition but rather a term used by psychologists to describe the negative effects of screen time. As the ubiquity of digital technology continues to increase, constant multitasking, rapid information processing, and continuous distractions may lead to decreased attention span, memory problems, and difficulty with cognitive functioning. Consequently, these effects may also increase anxiety, stress, and dependence on digital technology (Neurocenternj, 2023). The term properly encapsulates the growing health risks associated with the overconsumption of digital media and its effects on memory and concentration. This overarching problem may prove detrimental to the development of intellectual independence and the holistic growth of individuals.

As digital dementia becomes increasingly prevalent in society, its ubiquity has further highlighted the negative effects of screen time on memory. Excessive screen time causes chronic sensory overstimulation, which in turn decreases memory retention because of the constant bombardment of information and stimuli (Manwell et al., 2022). Forgetfulness continues to increase, and short-term memory continues to deteriorate as individuals rely more heavily on smartphones for even the smallest pieces of information. Because digital devices provide easy access to information, users are more likely to remember where to find a fact rather than the fact itself. Additionally, the abundance of hypertexts, texts containing links to other texts, allows users to scan documents superficially, resulting in poor memory recall (Moledina & Khoja, 2018).

Despite the negative effects, some studies suggest that digital technology may also provide certain memory benefits (Small et al., 2020; de Barros, 2024). Since both active and passive screen time are correlated with cognition and executive functioning, computer games that enhance working memory skills are associated with improved verbal and spatial memory abilities (Liu, 2022.). Furthermore, because gadgets externally store data, they may provide greater capacity for long-term memory (Moledina & Khoja, 2018). A study by Liu (2022) suggests that although there is no definitive correlation between screen time and memory retention, the effects of screen time on memory may depend on the quality of the screen time experience or the content being consumed. The greater screen time is associated with a lower likelihood of having stronger working memory.

Studies also suggest that excessive screen time may hinder concentration. Smartphone use primarily stimulates the left side of the brain, which is opposite the side associated with concentration, leaving the latter underutilized and susceptible to degradation (Moledina & Khoja, 2018). A study conducted by Microsoft Canada (2015) found that the average attention span of an individual has decreased to only eight seconds. This decline has been directly attributed to frequent screen time and rapid information overload (Neurocenternj, 2023). This decline in concentration appears to be more concerning among children, as they spend hours per day on screen time and continue to exhibit declining attention spans over time (Mupalla et al., 2023).

Excessive screen time has also been shown to deplete an individual's mental reserves because of high levels of visual and cognitive input (Devi & Singh, 2023; Mupalla et al., 2023). This depletion of mental reserves may further contribute to reduced concentration and attention span. As such, multiple studies appear to agree that the steadily declining concentration and attention span among individuals may be attributed to excessive screen time (Kar et al., 2025; Devi & Singh, 2023; Mupalla et al., 2023). Furthermore, excessive screen time has been shown to overstimulate the brain, making individuals less likely to enter a state of "deep concentration."

3. Methodology

3.1. Design of the Study

Given that the objective is to establish the relationship between screen time, memory, and concentration among adolescent high school students, the study utilized a quantitative correlational research design. Due to the nature of the performance tasks administered, the study also adopted a quasi-experimental method. Accordingly, data were collected through a questionnaire designed to evaluate the respondents' amount of screen time, as well as through performance tasks that measured both memory and concentration. A non-probability sampling technique known as purposive sampling, was also utilized.

3.2. Samples and Setting

The participants in the performance tasks were Grade 7 to 12 students from a private school in Manila, Philippines, ranging from 12 to 19 years old. The school utilizes an individualized mastery-based system under Accelerated Christian Education/School of Tomorrow. This curriculum uses self-instructional Packets of Accelerated Christian Education (PACEs). The individualized nature of this learning system naturally minimizes students' exposure to screens during school hours. However, this does not apply to senior high school students from Grades 11 to 12, whose learning style incorporates digital devices in the learning process. As a result, these students experience a greater frequency of screen time than junior high school students.

As of School Year 2024–2025, the total population of high school students was 68, while the total number of participants in the study was 53.

3.3. Data Collection Instruments and Procedures

The researcher collected data from the participants using both performance tasks and a survey collectively composed of five sections: first, the RAVLT; second, the questionnaire for the participants' demographic information; third, the questionnaire for the participants' screen time information; fourth, the Stroop Test; and lastly, the delayed RAVLT. Since the RAVLT is primarily administered auditorily, the researcher conducted this test in a quiet area with little to no distractions to ensure optimal performance. Furthermore, the test was administered through a pre-recorded audio that explained the rules and instructions. The audio also presented the words at a speed of one word per minute and repeated them over multiple trials to ensure proper comprehension by the participants.

The participants answered the questionnaires for demographic and screen time information digitally using devices provided by the researcher. The researcher read the questionnaire items aloud to the participants, who then provided their answers, which the researcher entered into a secure centralized data sheet.

Since the Stroop Test heavily relies on color recognition, the researcher conducted this test in a room with sufficient lighting to ensure that participants could properly identify all colors. The test was administered through an online website that automatically recorded the completion time. The participants were explicitly instructed to read the color rather than the word itself. Before taking the actual test, the participants completed an official practice sheet. The first part of the Stroop Test displayed words that were congruent with the color, while the second part displayed words that were incongruent with the color of the word. At the end of the test, the researcher recorded the completion times for both sections.

The researcher conducted the delayed RAVLT after a 20-minute interval following the administration of the RAVLT. The time of administration was recorded for the first trial of the RAVLT at the beginning of the test and administered the delayed RAVLT exactly 20 minutes later. During the delayed RAVLT, participants no longer listened to the same list of words and instead recalled them from memory without aid or assistance.

Among the participants, only students who provided consent to participate in the study completed the performance tasks. The researcher scored the questionnaire using two methods. The recorded sections involving the delayed RAVLT, RAVLT, and Stroop Test on a physical scoring sheet were later entered into a secure database. The questionnaire sections were administered through Google Forms. The researcher then compiled all data from each test into a single data sheet, removed the names of individual test takers, and translated the data into either continuous or scaled scores. The estimated time for each participant to complete the entire performance task ranged from 20 to 30 minutes.

The inclusion criteria for the current study consist of adolescent students aged 12 to 19 years old. These students must currently be enrolled in Grades 7 to 12. Both male and female students are eligible to participate in the study. In addition, the participants must not have a diagnosis or symptoms of any form of color blindness or hearing loss. Information regarding the diagnosis of color blindness and hearing loss was provided by the parents of the respondents through the distributed parental consent forms. Only students whose parents or guardians provided consent through the parental consent form were eligible to participate.

3.4. Ethical Considerations

This study adhered to ethical standards for research involving human participants. Since the majority of the respondents were minors, the researchers obtained informed consent from both the participants and their parents or guardians prior to data collection. All participation was voluntary, and the respondents were informed of their right to withdraw from the study at any time without penalty.

The study anonymized all collected data to ensure confidentiality and privacy and excluded all personally identifiable information from the analysis. Furthermore, all procedures were conducted in a controlled and safe environment to ensure the well-being of the participants.

3.5. Data Analysis Procedures

The study featured three variables: screen time, concentration, and memory retention. The researcher used Microsoft Excel and Google Sheets functions to carry out statistical procedures. The study utilized both descriptive and inferential statistics using the Statistical Package for the Social Sciences (SPSS).

4. Findings and Discussions

4.1. Internal Consistency and Validity of RAVLT and Stroop Test

Both the RAVLT and Stroop Test are standardized neurological tests widely used by neuropsychologists and medical practitioners around the world for psychological assessments.

Thus, both tests have undergone numerous testing procedures prior to publication and have consistently proven to be valid measures of memory and concentration (Ritvo et al., 2012).

The study used Cronbach's α to determine the internal consistency of both the RAVLT and the screen time questionnaire. Since the survey was not standardized, the overall reliability coefficient (Cronbach's α) of the questionnaire was 0.528, indicating average reliability. This result may be attributed to the subjective nature of the questionnaire, which may have influenced the reliability outcomes. The values of Cronbach's α for the questionnaire are presented in Table 1.

Table 1

Reliability of questionnaire

Cronbach's α	Cronbach's α on standardized items	N of items
.528	.455	9

The overall reliability coefficient (Cronbach's α) of the Stroop Test and the RAVLT in the current study was 0.67. Since both the Stroop Test and the RAVLT are standardized tests, the overall reliability coefficient was 0.79, indicating above-average internal consistency. These values are presented in Table 2.

Table 2

Reliability of Stroop Test and RAVLT

Cronbach's α	Cronbach's α on standardized items	N of items
.666	.791	8

4.2. Tests of Normality and Linearity

To determine whether parametric or non-parametric tests should be used, normality and linearity tests are essential. For this study, the Shapiro-Wilk Test and the Kolmogorov-Smirnov Test were utilized. A significance level of less than .05 was considered statistically significant and indicative of a skewed distribution. The results of the normality and linearity tests are presented in Table 3.

Table 3

Tests of normality and linearity

	Kolmogorov-Smirnov Test			Shapiro-Wilk Test		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
RAVLT #5	.156	53	.003	.932	53	.005
RAVLT #6	.129	52	.031	.933	52	.006
Stroop Test (Seconds)	.082	53	.200	.935	53	.058

Legend: Since Sig. of the RAVLT Trials 5 and 6 are not greater than .05, it is therefore not normally distributed.

4.3. Description of the Average RAVLT and Stroop Test Scores

The mean scores for each trial of the RAVLT, including the number of intrusions and repetitions per trial, as well as the average completion time for the Stroop Test, are presented in Tables 4 and 5.

Table 4

Average Stroop test score

Stroop Test (Seconds)	26.040

Table 5

Average RAVLT score

Trial	Total Recall	Repetitions	Intrusions
RAVLT 1	6.019	1.611	1.333
RAVLT 2	7.960	1.377	1.415
RAVLT 3	9.811	1.075	2.208
RAVLT 4	10.717	1.377	2.070
RAVLT 5	11.132	1.434	2.906
RAVLT 6	9.811	1.509	3.292

4.4. Description of the Screen Time of the Participants

The participants used an average of 2.415 screens per day. The frequency distribution of the number of screens used daily, as well as the average number of screens used by the partiipants, is presented in Table 6.

Table 6

Frequency distribution for number of screens everyday

Number of Screens	Frequency	Percentage
1	7	13.21%
2	24	45.28%
3	17	32.08%
4	3	5.66%
5	2	3.77%

Average number of screens used every day = 2.415

Smartphones were the most commonly used screens among the respondents. The most frequently used screens are shown in Figure 1.

Figure 1

Most used screen

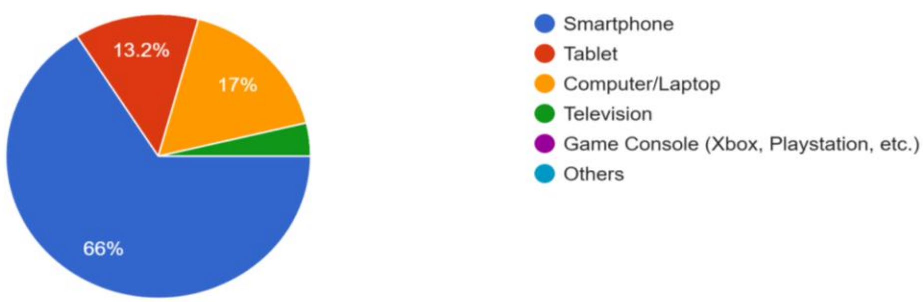

Table 7 shows the amount of time spent using each device per day, as well as the total amount of time spent across all devices.

Table 7

Average time on each screen

Type of Screen	Average Time (Hours)
Smartphone	4.377
Tablet	.858
Computer/Laptop	2.854
TV	.901
Game Console	.126
Other Devices	.025
Total	**8.899**

The recommended amount of screen time for this age group is only two hours of total screen time per day. This indicates that the respondents spend approximately 4.5 times longer on screen time than the recommended duration.

4.5. Significance of Demographic Variables

The demographic variables of the participants were analyzed in relation to the different aspects of the performance tasks administered, specifically the amount of screen time, the type of screen used, the different RAVLT trials, and the Stroop Test.

Table 8

Descriptive statistics (grouped by biological sex)

Sex		N	Mean	Std. Deviation
# of Screens used everyday	1	29	2.24	0.912
	2	23	2.65	0.935
Time (Smartphone)secs	1	29	14648.28	9678.054
	2	23	17060.87	11369.566
Time (Tablet)secs	1	29	2855.17	5783.201
	2	23	3521.74	6960.339
Time (Laptop)secs	1	29	11234.48	12346.32
	2	23	8882.61	9243.408
Time (TV)secs	1	29	1613.79	3760.198
	2	23	5439.13	6119.027
Time (Game Console) secs	1	29	764.69	2781.662
	2	23	78.26	375.326
Time (Other device) secs	1	29	124.14	668.503
	2	23	51.65	247.715
Total Time (seconds)	1	29	31260.41	15765.315
	2	23	32999.48	11593.558
Stroop Test (seconds)	1	29	24.97321	6.103412
	2	23	27.45352	5.102113
RAVLT #1	1	29	6.24	2.231
	2	23	5.83	1.85
RAVLT #2	1	29	8.21	2.21
	2	23	7.39	2.658
RAVLT #3	1	29	10.66	2.832
	2	23	9.09	3.118
RAVLT #4	1	29	11.14	2.167
	2	23	10.13	2.768
RAVLT #5	1	29	11.41	2.212
	2	23	11.39	2.888
RAVLT #6	1	29	9.62	3.448
	2	23	10.13	3.094
RAVLT List B	1	29	5.14	1.827
	2	23	4.87	1.66

A value of 1 was assigned to male respondents, while a value of 2 was assigned to female respondents. For uniformity, all time values were converted into seconds. Table 8 presents the frequency of both male and female respondents, the variables analyzed, the mean values of the variables analyzed, and their corresponding standard deviations.

The mean scores of both male and female respondents across the different variables suggest that female respondents collectively spent more time on screen use than male respondents, particularly in the use of smartphones, tablets, and televisions. Furthermore, the data suggest that female respondents also performed collectively worse in almost all aspects of both the RAVLT and the Stroop Test, with the exception of RAVLT #6, which measures long-term memory.

The study used the Mann-Whitney U Test to compare male and female participants across all dependent variables. They set the confidence level at 95%. The results showed no significant differences between male and female participants across most variables, except for television viewing time, in which female participants spent more time than male participants.

The grade levels of the respondents were also compared with the dependent variables. The respondents were classified into two groups: Junior High School (JHS) and Senior High School (SHS). Table 9 presents the frequency of both JHS and SHS respondents, the variables analyzed, the mean values of the variables analyzed, and their corresponding standard deviations.

Table 9

Associations Between Levels and All Dependent Variables

Level		N	Mean	Std. Deviation
Number of Screens used everyday	JHS	39	2.41	1.019
	SHS	13	2.46	0.66
Time (Smartphone)secs	JHS	39	13984.62	8880.42
	SHS	13	20907.69	13156.397
Time (Tablet)secs	JHS	39	3323.08	6510.173
	SHS	13	2630.77	5721.216
Time (Laptop)secs	JHS	39	6807.69	9490.615
	SHS	13	20353.85	9160.114
Time (TV)secs	JHS	39	3876.92	5651.337
	SHS	13	1592.31	3449.749
Time (Game Console) secs	JHS	39	522.46	2368.911

Level		N	Mean	Std. Deviation
	SHS	13	276.92	998.46
Time (Other device) secs	JHS	39	92.31	576.461
	SHS	13	91.38	329.492
Total time (seconds)	JHS	39	28621.85	12827.922
	SHS	13	42252.92	12551.12
Stroop Test (seconds)	JHS	39	26.39974	5.476184
	SHS	13	25.08185	6.696706
RAVLT #1	JHS	39	6.05	1.932
	SHS	13	6.08	2.499
RAVLT #2	JHS	39	7.77	2.507
	SHS	13	8.08	2.253
RAVLT #3	JHS	39	9.97	3.313
	SHS	13	9.92	2.1
RAVLT #4	JHS	39	10.72	2.47
	SHS	13	10.62	2.599
RAVLT #5	JHS	39	11.62	2.413
	SHS	13	10.77	2.774
RAVLT Trial 6	JHS	39	10.44	2.644
	SHS	13	8.08	4.349
RAVLT List B	JHS	39	4.85	1.71
	SHS	13	5.54	1.808

When the JHS and SHS students are compared in terms of their use of screen devices, mean scores on the Stroop Test and RAVLT, and other continuous variables, there was no significant differences except for the following: Time spent using a laptop per day, where $\rho = .000$, with SHS students demonstrating greater usage time than JHS students. Time spent watching television per day, where $\rho = .045$, with JHS students averaging more viewing time than SHS students. Total daily screen time, where $\rho = .004$, with SHS students averaging a greater total screen time than JHS students.

4.6. Significance of Screen Time on RAVLT and Stroop Test

Participants were also grouped according to the devices they used most frequently each day. Table 10 presents the frequency, mean, and standard deviation of the variables analyzed. Of the 52 participants who answered this part of the survey, 34 participants indicated that smartphones were the devices they used most frequently in a day, followed by laptops and/or computers, tablets, and televisions.

When groups across all continuous variables are compared, particularly the Total Recall scores of the RAVLT and the Stroop Test results, using the Kruskal-Wallis Test, there was no significant differences except for Trial 3 of the RAVLT, where $\rho = .046$. Smartphone users obtained the lowest mean score compared with users of other devices. Meanwhile, the two participants who identified television as their most frequently used screen achieved the highest mean Total Recall score on the RAVLT, with a mean score of m = 14.

Table 10

Grouping according to the most used devices

Variable		N	Mean	Std. Deviation
Number of Screens used everyday	Smartphone	34	2.32	1.007
	Laptop	9	2.56	0.726
	Tablet	7	2.43	0.787
	TV	2	3.5	0.707
	Total	52	2.42	0.936
Time (Smartphone) secs	Smartphone	34	19058.82	9587.559
	Laptop	9	12600	8632.497
	Tablet	7	4371.43	9286.857
	TV	2	12600	2545.584
	Total	52	15715.38	10423.529
Time(Tablet) secs	Smartphone	34	688.24	1880.807
	Laptop	9	2000	4800
	Tablet	7	17228.57	3868.555
	TV	2	900	1272.792
	Total	52	3150	6274.739
Time (Laptop)secs	Smartphone	34	6750	8314.582
	Laptop	9	27000	6854.196
	Tablet	7	6171.43	8747.898
	TV	2	7200	5091.169
	Total	52	10194.23	11042.457
Time (TV)secs	Smartphone	34	2514.71	4441.139
	Laptop	9	1200	1622.498
	Tablet	7	5657.14	5826.05
	TV	2	18000	0

Variable		N	Mean	Std. Deviation
	Total	52	3305.77	5253.063
Time (Game Console)secs	Smartphone	34	599.29	2532.699
	Laptop	9	400	1200
	Tablet	7	0	0
	TV	2	0	0
	Total	52	461.08	2104.137
Time (Other device) secs	Smartphone	34	140.82	644.254
	Laptop	9	0	0
	Tablet	7	0	0
	TV	2	0	0
	Total	52	92.08	522.634
Total time (seconds)	Smartphone	34	28322.47	12388.478
	Laptop	9	43464	14088.505
	Tablet	7	33428.57	15687.119
	TV	2	38700	8909.545
	Total	52	32029.62	13971.322
Stroop Test (seconds)	Smartphone	34	26.05259	6.18095
	Laptop	9	26.67789	4.773159
	Tablet	7	26.52114	5.910186
	TV	2	22.0585	2.263449
	Total	52	26.07027	5.764413
RAVLT(TC) #1	Smartphone	34	5.97	2.181
	Laptop	9	6.33	1.5
	Tablet	7	5.57	2.225
	TV	2	8	1.414
	Total	52	6.06	2.062
RAVLT(TC) #2	Smartphone	34	7.47	2.489
	Laptop	9	8.56	2.297
	Tablet	7	8.14	2.41
	TV	2	10	0
	Total	52	7.85	2.428
RAVLT(TC) #3	Smartphone	34	9.21	2.739
	Laptop	9	10.89	1.764
	Tablet	7	11.29	4.536
	TV	2	14	1.414
	Total	52	9.96	3.035

Variable		N	Mean	Std. Deviation
RAVLT(TC)#4	Smartphone	34	10.35	2.347
	Laptop	9	11.11	2.147
	Tablet	7	11	3.367
	TV	2	13.5	2.121
	Total	52	10.69	2.478
RAVLT(TC)#5	Smartphone	34	10.97	2.599
	Laptop	9	11.56	2.068
	Tablet	7	12.71	2.289
	TV	2	13.5	2.121
	Total	52	11.4	2.507
RAVLT(TC) Trial 6	Smartphone	34	9.09	3.397
	Laptop	9	10.89	2.205
	Tablet	7	11.57	3.155
	TV	2	12	2.828
	Total	52	9.85	3.274
RAVLT(TC) List B	Smartphone	34	4.94	1.369
	Laptop	9	5.67	2.449
	Tablet	7	4.57	1.902
	TV	2	5	4.243
	Total	52	5.02	1.743

4.7. Correlations

Based on the results of the Kruskal-Wallis Test shown on page 65, it can be inferred that smartphone use, being the most widely used device among the participants, may have either negative or positive correlations with the Stroop Test and RAVLT Total Recall results. Using Spearman Rank Correlation, Table 11 presents the relationships between smartphone use, the Stroop Test results, and the RAVLT results. Moreover, the researchers selected the one-tailed pairwise option because the hypotheses predicted a specific direction in the relationship between the variables.

The results indicate a negative correlation between smartphone usage time and the Stroop Test and RAVLT Total Recall scores. As smartphone usage increases, the scores on the Stroop Test and RAVLT decrease. Among these findings, only the results for RAVLT Trials 5 and 6 were statistically significant.

Table 11

Relationships between use of smartphones and the Stroop test and RAVLT results

Dependent Variables	Time on Smartphones in seconds (Independent Variable)	
	Correlation Coefficient	Sig.(1-tailed)
Stroop Test (in seconds)	-0.160	.125
RAVLT (Total Recall) Trial 1	-0.018	.450
RAVLT (Total Recall) Trial 2	-0.124	.189
RAVLT (Total Recall) Trial 3	-0.143	.153
RAVLT (Total Recall) Trial 4	-0.198	.078
RAVLT (Total Recall) Trial 5	-0.243*	.040
RAVLT (Total Recall) Trial 6	-0.223*	.056

Legend: *Correlation is significant at the 0.05 level (1-tailed).

Correlations, using Spearman Rank Correlations, were also tested between all continuous variables.

Table 12

Age and Screen Time Usage (Laptop and TV)

Dependent Variable	Age (Independent Variable)	
	Correlation Coefficient	Sig.(1-tailed)
Time (Laptop Usage in seconds)	.444**	.000
Time (TV Watching in seconds)	-.406**	.001

Legend: ** Correlation is significant at the 0.01 level (1-tailed).
* Correlation is significant at the 0.05 level (1-tailed).

Table 12 shows a significant positive correlation between age and laptop usage. As age increases, daily laptop usage also increases. In contrast, the table also shows a significant negative correlation between age and daily television viewing. As age increases, the amount of time spent watching television decreases.

Table 13 shows a positive correlation between the number of screens or devices used per day and the RAVLT Total Recall score for Trial 2. A significant positive relationship between the number of screens or devices used per day and the mean RAVLT Total Recall score for Trial 2 may suggest that frequent device usage enhances certain cognitive skills, such as multitasking and rapid information processing. These skills may indirectly support verbal memory performance during early learning trials, such as Trial 2. Additionally, exposure to diverse digital content may stimulate memory encoding and retrieval processes, thereby contributing to better recall (Călinescu, 2024; Sharifian & Zahodne, 2020).

Table 13

Relationship between number of screens used in a day and RAVLT

Dependent Variable	**Number of Screens/Devices Used in a Day (Independent Variable)**	
	Correlation Coefficient	Sig.(1-tailed)
RAVLT Total Recall Trial 2	.338**	.007

As shown in Table 14, when the mean scores of the Stroop Test were correlated with the mean scores of RAVLT Trials 1–6 and List B, a negative correlation was observed, except for RAVLT Trial 1. This indicates that as Stroop Test scores increased, RAVLT Total Recall scores decreased. However, only the correlation between the Stroop Test and RAVLT Total Recall List B was statistically significant.

Table 14

Relationship between Stroop test and RAVLT total recall mean scores

Dependent Variable	**Stroop Test Mean Score (in seconds) (Independent Variable)**	
	Correlation Coefficient	**Sig.(1-tailed)**
RAVLT Total Recall Trial 1	.190	.087
RAVLT Total Recall Trial 2	-.181	.097
RAVLT Total Recall Trial 3	-.056	.345
RAVLT Total Recall Trial 4	-.204	.071
RAVLT Total Recall Trial 5	-.082	.280
RAVLT Total Recall Trial 6	-.041	.388
RAVLT Total Recall List B	-.293*	.017

The Stroop Test measures cognitive control and selective attention, while the RAVLT Total Recall assesses verbal memory and learning. A negative correlation between these scores may occur if individuals with higher cognitive control, as reflected by better Stroop performance, allocate fewer cognitive resources to memory tasks, potentially resulting in lower RAVLT scores (Rondeel et al., 2015). Conversely, individuals who focus more on memory tasks may demonstrate reduced efficiency in cognitive control, thereby affecting Stroop Test performance.

This relationship highlights the balance between attention and memory abilities. It may also guide interventions for conditions such as Attention Deficit Hyperactivity Disorder (ADHD) or age-related cognitive decline by helping researchers and practitioners design training programs that effectively improve both skills (Rondeel et al., 2015).

As shown in Table 15, when the mean scores of the RAVLT Total Recall were compared with one another, significantly high positive correlations were observed between RAVLT Trial 2 and RAVLT Trials 3–6, as well as List B.

Table 15

Relationship between RAVLT Trial 2 and Trials 3-6 List B

Dependent Variable	**RAVLT Total Recall Trial 2 Mean Score (in seconds) (Independent Variable)**	
	Correlation Coefficient	Sig.(1-tailed)
RAVLT Total Recall Trial 3	.687**	.000
RAVLT Total Recall Trial 4	.614**	.000
RAVLT Total Recall Trial 5	.594**	.000
RAVLT Total Recall Trial 6	.591**	.000
RAVLT Total Recall List B	.436**	.001

Legend: **. Correlation is significant at the 0.01 level (1-tailed).

A significant positive correlation between the RAVLT Total Recall mean scores of Trial 2 and those of Trials 3–6 and List B suggests that individuals who perform well during the early learning trials, such as Trial 2, also tend to maintain strong performance in subsequent learning trials and interference tasks. This finding indicates consistent verbal learning and memory retention abilities. It also reflects effective encoding strategies and cognitive flexibility, as participants are able to adapt and recall information even when presented with interference (Schmidt, 1996).

5. Conclusion

The participants in this study spent approximately 4.5 times longer on screen time than the recommended duration. As such, excessive screen time has become increasingly prevalent among adolescents. Furthermore, the study found a statistically significant relationship between screen time and the memory retention and concentration of adolescents. This statistical significance was particularly evident in smartphone use.

The study also considered demographic variables such as grade level and gender. Although the results suggest that these variables do not have a statistically significant relationship with memory retention and concentration, significant relationships were still observed when these variables were compared with other factors. However, other external factors may also influence the memory retention and concentration of adolescents. These factors may include the emotional state of the respondents at the time of testing, the duration and quality of sleep prior to the test, biological factors, and numerous other possible influences. Furthermore, because of the auditory nature of the test, some respondents may have performed better on a visual memory test, which could have produced different results.

Despite the possible contributing factors, the findings of this study still emphasize that the unhealthy duration of screen time among adolescents today, particularly smartphone use, contributes to declines in both memory retention and concentration. The results of this study not only demonstrate the negative correlation between excessive screen time and cognitive performance but also strengthen the growing concern regarding excessive screen time among adolescents. If neglected, this concern may contribute to the development of "digital dementia" among adolescents, which may negatively affect not only their academic performance but also their overall lifestyle and well-being. Screen time remains highly prevalent today and has even become integrated into various modes of learning. Nevertheless, individuals should not become complacent and should instead focus on developing healthier and more responsible screen time habits. Such changes may include limiting smartphone use or engaging in active recreational activities instead of relying on easily accessible smartphone entertainment.

Regardless of the external factors that may not have been accounted for in the study, memory retention and concentration remain essential for the cognitive growth and holistic well-being of adolescents. Given the correlations identified in this study, improving memory retention and concentration depends largely on the conscious choices individuals make each day. Therefore, improving these cognitive abilities becomes not only a matter of lifestyle but also a personal commitment to changing controllable habits, ultimately placing the responsibility for improvement in the hands of the individual.

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Institutional Review Board Statement

This study adhered to ethical standards for research involving human participants by obtaining informed consent from both the participants and their parents or guardians prior to data collection. All procedures were conducted in a controlled and safe environment to ensure the well-being of the participants.

AI Declaration

The author declares the use of Artificial Intelligence (AI) in writing this paper. In particular, the author used Gemini to aid in searching appropriate literature, summarizing key points, and language editing.

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