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Associations between Duration and Type of Electronic Device Use and Sleep Quality among Bangkok's High School Students

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ABSTRACT: High school students are increasingly relying on electronic devices for academics, leisure, and social interactions. Concerns have emerged regarding the impact of extensive device use on adolescent sleep quality, critical for well-being during this transformative phase. Past studies suggest that being exposed to prolonged screen time can disrupt sleeping patterns; interestingly, it can vary based on the device type or screen size as well as gender of users. Therefore, we conducted a study to examine the relationship between electronic devices used before bedtime and sleep quality among high school students in Bangkok, while considering device type, screen size, and gender as crucial variables. Our findings reveal a relationship between electronic device use before bed ($p=0.008$), and gender ($p=<0.001$) are associated significantly with sleep quality. Notably, we observed that prolonged screen time, particularly on larger screens like laptops ($p=0.049$), is associated with more disruptions in sleep patterns. Moreover, the duration of electronic devices usage before bed and gender has distinct and notable effects on sleep quality. However, high school students in Bangkok may have unique lifestyles that can significantly impact how electronic devices are integrated into daily routines, potentially exacerbating sleep disruptions. Therefore, further research is required to seek other causes affecting sleep quality. This could be useful in promoting h.

KEYWORDS: Electronic Devices, High School Students, Screen time, Sleep Quality.

INTRODUCTION

In the contemporary digital landscape, electronic devices have become ubiquitous, particularly among adolescents. High school students, specifically, have increasingly integrated electronic devices into their daily lives for academic, leisure, and social activities (LeBourgeois et al., 2017; Twenge & Campbell, 2018). However, concerns have arisen regarding the potential impact of extensive device usage on sleep quality, a critical facet of adolescent well-being (Carskadon & Acebo, 2002).

Sleep is a fundamental physiological process essential for cognitive functioning, emotional regulation, and physical health, with particular importance during adolescence, marked by significant physical and psychological changes (World Health Organization, 2020). Recent studies indicate a rising trend of sleep disturbances among adolescents, partly attributed to excessive electronic device use (Hysing et al., 2015).

Research exploring the connection between electronic device use and adolescent sleep quality has gained momentum. Numerous studies suggest links between prolonged screen time and disrupted sleep patterns, including delayed sleep onset, reduced sleep duration, and compromised sleep quality (Raman & Subramaniam, 2019). Additionally, specific device types, such as smartphones, tablets, computers, and gaming consoles, may exert distinct effects on sleep due to differences in content, interactivity, and potential for blue light exposure (Hysing et al., 2015).

Recent investigations have examined the impact of screen size on sleep quality outcomes. Chang et al. (2022) found that larger screens, like desktop computers and televisions, were associated with more significant disruptions in sleep patterns compared to smaller screens such as smartphones and tablets. Conversely, Lee et al. (2023) reported better sleep quality for those using smaller screens before bedtime. These findings highlight the potential influence of screen size on sleep outcomes due to variations in light intensity and screen proximity.

Furthermore, research by Smith et al. (2022) indicates that pre-sleep phone use patterns may affect sleep quality differently, with distinct effects for pre-bed-time phone use and bed-time phone use. This study aims to explore these effects by examining phone use before bed and its relation to sleep quality among Bangkok's high school students aged 15 to 19.

What sets this study apart is its focused exploration of the combined impact of device type, screen size, and gender on sleep quality among high school students in Bangkok. By considering these factors, our research seeks to reveal associations between electronic

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device use, screen size, type, and sleep quality in this specific population. Importantly, McManus et al. (2022) underscored intriguing gender-related divergence identified which is a crucial factor in comprehending the intricate relationship between electronic device use and sleep quality among adolescents.

This survey research, therefore, aims to uncover the associations between electronic device use, screen size, type, and sleep quality among high school students in Bangkok. By elucidating these relationships, the study aims to identify potential risk factors and guide interventions to promote healthier device habits and improved sleep hygiene in this vulnerable adolescent population.

METHODOLOGY

A target sample size of 817 participants (754 after list-wise deletion) were recruited online from high schools in Bangkok. A stratified random sampling technique was employed by (1) posting links into various group chats of different grade levels and (2) inviting our social media followers, which are mostly consisted of high school students studying in Bangkok to ensure a representative sample across different grade levels and genders. A comprehensive questionnaire consisting of 22 questions (19 compulsory questions) was developed and underwent validation processes, including expert review and pilot testing. Informed consents were obtained from participants, ensuring their confidentiality and anonymity. The survey was conducted online using the Google Forms platform, with the survey link distributed to high school students from July 12th to July 19th. The survey includes sections on general information, duration and types of electronic device use, and the Pittsburgh Sleep Quality Index (PSQI) to measure sleep quality. The Pittsburgh Sleep Quality Index (PSQI) created by Buysse, et al. (1989), will be used to measure sleep quality. The questionnaire consists of 19 items, which assess subjective sleep quality, sleep onset, actual sleep duration, sleep efficiency, sleep disturbances, use of sleep medication, and daytime functioning difficulties. Each item is scored on a scale ranging from 0 to 3, and the scores will be combined to create a global score ranging from 0 to 21. A global score greater than 5 will indicate clinically significant levels of poor sleep quality. The index showed acceptable internal reliability of 0.552 by using Cronbach's Alpha reliability test provided from the Statistical Package for the Social Sciences (SPSS) software 29.0. Survey participants provided information regarding their typical bedtime at night and wake-up time in the morning. To create a measurable variable, hours were represented on a 24-hour scale, with hours after midnight counted as 25:00 (for 1:00), 26:00 (for 2:00), and so forth. Sleep duration is a key aspect of the PSQI, which consists of seven components. To assess sleep duration, respondents were asked to report the average number of hours they slept per night over the previous month. We included gender (coded as 1 for male and 2 for female), age, and grade level as control variables. To assess respondents' educational level, they were asked to indicate their current grade level between grade 9 and 12. For all analysis, the Statistical Package for the Social Sciences (SPSS) for Windows (Version 29.0, Chicago, IL, USA) and statistic significant was used in statistic hypothesis of research is 0.05 (α=0.05). Correlations between sleep variables, bedtime electronic devices usage and control variables were computed using Pearson correlation analysis and multiple correlation. Missing observations were handed in by list-wise deletion.

RESULTS

Analysis and Presentation of Research Findings on the Study of High School Students' Electronic Device Utilization Behavior in Bangkok and its Impact on Sleep Quality, Illustrated in Tabular Format

1. Presentation of Data Analysis Pertaining to the Personal Characteristics of Students, Evidenced by Frequency and Percentage Values
2. Illustration of Data Analysis on the Utilization of Electronic Devices by Each Type among Students, Categorized by Age, Gender, and Grade Level, Displayed in Frequency Distribution
3. Computation of Data Derived from Pittsburgh Sleep Quality Index (PSQI) Assessment
4. Display of Analyzed Results of Average Time Disparities Associated with the Usage of Various Electronic Devices among Students
5. Elucidation of Relationship Analyses, Segmented into Four Distinct Cases:
    - 5.1 Relationship Between Different Types of Electronic Device Usage Among Students and Sleep Quality
    - 5.2 Correlation Between the Personal Characteristics of Students and Sleep Quality
    - 5.3 Association Between Various Types of Electronic Device Usage by Students Before Bedtime and Sleep Quality
    - 5.4 Correlation Between the Total Usage Duration of Each Electronic Device Type and Sleep Quality

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5.5 Presentation of Discrepancies in Sleep Quality Scores Between Male and Female Students
6. Results of Analyzing the Difference in Sleep Quality Scores between Male and Female Students
Subsequently, the researchers will proceed to undertake data analysis and disseminate the research findings in a structured manner through the following six stages:

1. Presentation of Data Analysis Pertaining to the Personal Characteristics of Students, Evidenced by Frequency and Percentage Values (Tables 1-3)

Table 1: Statistics of the respondents' demographics including gender, age, and educational level (n = 754)

Personal information	Number of participants	Percentage
1) Gender		
Male	163	21.6
Female	591	78.4
Total	754	100
2) Age		
15	246	32.6
16	142	18.8
17	165	21.9
18	114	15.1
19	87	11.6
Total	754	100
3) Education Level		
Grade 9	141	18.7
Grade 10	143	18.9
Grade 11	183	24.3
Grade 12	287	38.1
Total	754	100

According to the table, the predominant of respondents (n = 754) were female, contributed 78.4% of the total responses. Most participants were 15 years old, accounting for 32.6%. Respondents were most common in grade 12 and 11, there were barely any differences in the number between 9th graders and 10th graders. Most students in this research were female.

2. Illustration of Data Analysis on the Utilization of Electronic Devices by Each Type among Students, Categorized by Gender

Table 2: The number of students' time spent on each type of electronic device, categorized by gender

Duration	Gender	TV	PC	NB	SM	TB
No usage	Male	99	100	75	1	34
	Female	299	371	300	6	131
Less than 2 hours	Male	50	33	46	18	23
	Female	228	170	190	21	71

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2 – 4 hours	Male Female	9 51	19 39	27 67	48 135	39 126
4 – 6 hours	Male Female	4 9	8 7	8 23	41 187	37 139
6– 8 hours	Male Female	1 4	0 3	3 6	24 106	17 63
More than 8 hours	Male Female	0 0	3 1	4 5	31 136	13 61
Total		754	754	754	754	754

* TV= Television, PC= Desktop PC, NB= Laptop, SM= Smartphone, TB= Tablet

From **Table 2**, which presents the number of students spending an average time with each type of electronic device, categorized by gender, it is observed that the highest number of female students who spend more than 2 hours with mobile phones is 564 individuals. Following closely are those using computers or tablets, totaling 389 students. In contrast, among male students, the largest group spending the most time with mobile phones consists of 144 individuals, with 106 students using computers or tablets. For those who use electronic devices for less than 2 hours, the preferred devices are televisions, personal computers (PCs), and laptops.

3. Computation of Data Derived from Pittsburgh Sleep Quality Index (PSQI) Assessment

The calculation of the Pittsburgh Sleep Quality Index (PSQI) for the questionnaire respondents, who in this research study are students, will involve data from a total of 754 individuals, comprising 163 males and 591 females. The questionnaire used in the research includes a set of questions that measure the PSQI, which has been translated into the Thai language and rigorously tested for accuracy and reliability. The questionnaire comprises 9 questions, divided into 7 components, as follows:

1. Component 1: Subjective Sleep Quality, found in Question 6
2. Component 2: Sleep Latency and Sleep Duration, located in Questions 2 and 5.1
3. Component 3: Actual Sleep Duration Each Night, present in Question 4
4. Component 4: Habitual Sleep Efficiency, included in Questions 1, 3, and 4
5. Component 5: Sleep Disturbances, encompassed by Questions 5.2 – 5.10
6. Component 6: Use of Sleep Medication, covered in Question 7
7. Component 7: Daytime Dysfunction, addressed in Questions 8 and 9

Regarding the method for calculating data from the questionnaire in Section 3, which assesses the sleep quality of students, it has been previously outlined in Section 3.2 - Research Instruments. Following the analysis of student questionnaire data, it has been summarized that there are 163 male students and 591 female students. It was observed that the sleep quality of male and female students aligns with the data presented in Table 3.

Table 3: The results of the analysis of sleep quality scores of students, categorized by gender

Gender	Highest score	Lowest score	Average score	S.D.	Number
Male	17	2	6.50	2.194	163
Female	16	2	7.26	2.195	591
Total	17	2	7.09	2.194	754

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From the data presented in Table 3, it is evident that the sleep quality scores of both male and female students fall above the threshold of 5 points, which categorizes them into the poor sleep quality. In other words, many students in both gender groups have sleep quality scores below or equal to 5, indicating poor sleep quality. This information has been illustrated in **Table 4.**

Table 4: The results of the analysis of sleep quality status, separated by gender of the students

Gender	Good sleep quality	Bad sleep quality	Total
Male	55 (33.74 %)	108 (66.26 %)	163 (100.00 %)
Female	121 (20.47 %)	470 (79.53)	591 (100.00 %)
Total	176	578	754

From **Table 4**, it is observed that among the questionnaire respondents, there were 163 male students, with 55 individuals (33.74%) having good sleep quality and 108 individuals (66.26%) experiencing poor sleep quality. In contrast, among the 591 female respondents, 121 individuals (20.47%) had good sleep quality, while 470 individuals (79.53%) had poor sleep quality. Notably, the proportion of females with poor sleep quality is higher than that of males, with percentages of 79.53% and 66.26%, respectively.

4. Display of Analyzed Results of Average Time Disparities Associated with the Usage of Various Electronic Devices among Students

The analysis of data regarding the differences in the average time spent by students on various electronic devices, categorized as Television (TV), Personal Computer (PC), Laptop (NB), Mobile Phone (SM), and Tablet Computer (TB), can be divided into 6-time intervals, as outlined in **Table 2**

Table 5: The average time spent using distinct types of electronic devices by students is presented along with the standard deviation

Types of electronic devices	Total number	Mean	S.D.	Lowest score	Highest score
Television (TV)	754	1.61	0.763	1	5
Desktop PC (PC)	754	1.53	0.823	1	6
Laptop (NB)	754	1.79	1.021	1	6
Smartphone (SM)	754	4.24	1.239	1	6
Tablet (TB)	754	3.18	1.585	1	6

Table 6: The results display the Mean and the Mean Rank for the usage of each type of electronic device

Types of electronic devices	Mean value	Mean Rank value
Television (TV)	1.61	2.23
Desktop PC (PC)	1.53	2.11
Laptop (NB)	1.79	2.41
Smartphone (SM)	4.24	4.56
Tablet (TB)	3.18	3.66

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Table 7: The Chi-Square result derived from the Friedman test to determine whether significant differences exist among the groups concerning their usage of electronic devices

Total number of students	754
Chi-Square	1629.186
Degree of Freedom: df	4
Asymptotic Significant (Asymp.Sig.)	< 0.001

For the study of differences in the average time spent by students using electronic devices of distinct types, hypothesis testing in research can be conducted as follows:

1. **Testing the Difference in the Mean Usage Time of Electronic Devices:** based on the hypothesis "The average usage time of electronic devices varies among different device types." This hypothesis can be tested using appropriate statistical methods, such as analysis of variance (ANOVA) or t-tests, for multiple group analysis.

H_0 : The average time spent by students using electronic devices of various types does not differ.

H_1 : There are at least two electronic devices for which the average time spent by students differs significantly.

H_0 : $\mu = 0$

H_1 : $\mu \neq 0$

From the statistics obtained from the program as shown in Table 8, it is found that the Mean Rank for the electronic devices (TV, PC, NB, SM, and TB) are 2.23, 2.11, 2.41, 4.56, and 3.66, respectively. The Chi-Square statistic ($\chi 2$) is 1629.186, and the Asymp.Sig value is < 0.001, which is less than the predetermined statistical significance level (α) of 0.05 in this research. Therefore, we reject the null hypothesis (H0) and conclude that the average time spent by students on distinct types of electronic devices is significantly different.

The next procedure is to perform pairwise comparisons to determine which pairs of electronic devices have significantly different average usage times.

2. **Pairwise Testing of the Differences in the Average Usage Time of Various Types of Electronic Devices:** To investigate whether there are differences in the average usage time among pairs of electronic devices, pairwise testing is conducted. This allows us to determine which pairs of electronic devices exhibit statistically significant differences in average usage time. To perform this analysis, research hypotheses and statistical assumptions are defined.

H_0 : The average time spent by students using electronic devices of various types does not differ.

H_1 : There are at least two electronic devices for which the average time spent by students differs significantly.

H_0 : $\mu = 0$

H_1 : $\mu \neq 0$

Table 8: Display the Wilcoxon Signed Ranks Test result to evaluate the pairwise difference of corresponding electronic devices

Devices pairwise	z-score	Asymp.Sig 2-Tailed (p-value)
PC - TV	-2.451 (Positive Rank)	0.014
NB - TV	-3.743 (Negative Rank)	< 0.001
SM - TV	-22.834 (Negative Rank)	< 0.001
TB - TV	-18.431 (Negative Rank)	< 0.001
NB - PC	-5.831 (Negative Rank)	< 0.001
SM - PC	-23.182 (Negative Rank)	< 0.001
TB - PC	-18.778 (Negative Rank)	< 0.001
SM - NB	-22.425 (Negative Rank)	< 0.001
TB - NB	-15.895 (Negative Rank)	< 0.001
TB - SM	-13.736 (Positive Rank)	< 0.001

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From the results of the Wilcoxon signed-rank test presented in Table 8, it is evident that the Asymp.Sig obtained for all device pairs are less than 0.001, except for the pair PC - TV, which has a p-value of 0.014. These p-values indicate the statistical significance of the differences in average usage times between the corresponding pairs of electronic devices.
Since all p-values are less than the chosen statistically significant (α) at 0.05 and meet the criterion for statistical significance, we reject the null hypothesis (**H_0**) that there are all differences in the average usage times of electronic devices. Therefore, based on the statistical significance level of 0.05, we can conclude that there are statistically significant differences in the average usage times of electronic devices within each pair.

5. Elucidation of Relationship Analyses, Segmented into Four Distinct Cases

To analyze the data related to the relationship between the usage patterns of various electronic devices, the personal characteristics of the survey respondents, their pre-sleep electronic device usage behavior, and the total daily screen time with the quality of sleep, we will formulate the following research hypotheses:

5.1 The relationship between the usage behavior of each type of electronic device by students and sleep quality.
5.2 The relationship between students' personal status and sleep quality
5.3 The relationship between students' pre-sleep usage behavior of distinct types of devices and sleep quality
5.4 The relationship between the total daily screen time of students using each type of device and sleep quality

The researchers would like to use the following symbols to define the independent variables to formulate statistical hypotheses to test the relationships in various scenarios as mentioned earlier:

1. **Independent variable I** in the hypothesis for Section 5.1 is the usage behavior of each type of electronic device, which is the average time spent using each type of electronic device by students (there are 5 subgroups: TV, PC, NB, SM, TB).
2. **Independent variable II** in the hypothesis for Section 5.2 is the personal status of students (age, gender, and grade level).
3. **Independent variable III** in the hypothesis for Section 5.3 is the average time spent using each type of electronic device in the period before bedtime by students.
4. **Independent variable IV** in the hypothesis for Section 5.4 is the total daily screen time of students using each type of electronic device.

The statistical hypotheses used to test for relationships will have the same format in all cases, with variations only in the independent variables. Therefore, the following format for the statistical hypotheses will be applied, representing independent variables I, II, III, and IV in each of the four scenarios, as follows:

H_0 : Each independent variable I, II, III, and IV are not correlated w ith the quality of sleep
H_1 : Some of the variable from independent variable I, II, III, and IV were correlated with sleep quality
H_0 : $\rho = 0$
H_1 : $\rho \neq 0$

The results of the statistical analysis using the SPSS software, which employed the Multiple Correlation Coefficient to test the relationships between the various independent variables mentioned earlier and the sleep quality scores, were examined using the F-Test and t-Test. The statistical values provided by the software are presented in Tables 9, 10, and 11.

Table 9: the mean and standard deviation values from the relationship analysis using the Multiple Correlation method through Regression Analysis

Independent variables	Mean	S.D.	Total number
Television (TV)	1.61	0.763	754
Desktop PC (PC)	1.53	0.823	754
Laptop (NB)	1.79	1.021	754
Smartphone (SM)	4.24	1.239	754
Tablet (TB)	3.18	1.585	754

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Age	16.54	1.378	754
Gender	1.78	0.412	754
Education Level	2.82	1.134	754
Total Hours	11.56	4.703	754
Hours Bf Bed	3.91	1.221	754
(Sleep Quality)	0.23	0.423	754

*TV, PC, NB, SM, TB have values ranging from 1 to 6, representing the duration of electronic device usage, from 0 to more than 8 hours.
** AGE has values ranging from 15 to 19.
*** Gender has values of 1 for male and 2 for female.
**** Education Level corresponds to the grade level and has values ranging from 1 to 4.
***** HoursBeforeBed represents the time spent using electronic devices before bedtime and has values ranging from 1 to 5.
****** Sleep Quality indicates the quality of sleep, with a value of 1 for good sleep quality and 0 for poor sleep quality. (PSQI score <= 5 is good sleep quality which converted to be 1 while PSQI>5 is poor sleep quality converted to be 0)

The analysis of data using the ANOVA method through multiple correlations with the F-Test to test the relationships among variable groups has resulted in statistical values as shown in **Table 10**. Additionally, the assessment of individual relationships using the regression analysis method, employing t-Test statistics, is presented in **Table 11**.

Table 10: The F-Test statistic obtained from the analysis of variance (ANOVA) using the multiple correlation method

	Sum of Square	**df**	**Mean Square**	**F**	**Sig**
Regression	5.517	10	0.552	3.168	< 0.001
Residual	129.401	743	0.174		
Total	134.918	753			

Table 11: The t-Test statistic obtained from the Regression Analysis

	Unstandardized Coefficient		**Standardized Coefficient Beta**	**t**	**Sig**
	B	Std. Error			
TV	0.054	0.038	0.097	1.413	0.158
PC	0.026	0.038	0.050	0.680	0.496
NB	0.077	0.039	0.186	1.975	0.049
SM	0.073	0.047	0.215	1.556	0.120
TB	0.069	0.041	0.259	1.686	0.092
Age	0.022	0.021	0.071	1.022	0.307
Gender	-0.130	0.038	-0.127	-3.431	< 0.001
Education Level	-0.012	0.026	-0.032	-0.469	0.639
Total Hours	-0.042	0.022	-0.462	-1.856	0.064
Hours Bf Bed	-0.034	0.013	-0.098	-2.677	0.008

In testing the correlation involving four independent variables, which include the behavior of using electronic devices of each type (**Independent Variable I**), personal demographics (**Independent Variable II**), the average time spent using electronic devices of

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each type before bedtime **(Independent Variable III**), and the total time spent using electronic devices of each type by students each day (**Independent Variable IV**), according to the statistical hypotheses mentioned earlier.
From **Table 10**, the calculated F-statistic is 3.168 (critical value), which yields a significance level (Sig) of less than 0.001. This value is smaller than the statistical significance level set at 0.05. Therefore, the null hypothesis (**H_0**) must be rejected, and we can conclude from the test that some of the independent variables (**Independent Variables I, II, III, IV**) are related to sleep quality.

Further analysis to be done to find out which relationship was correlated with sleep quality. From **Table 11**, the calculated t-statistics for the variables NB (Laptop computer), Gender, and the variable HoursBfBed (time spent using electronic devices before bedtime) have Sig. values of 0.049, < 0.001, and 0.008, respectively. All these values are less than the statistical significance level set at 0.05. Therefore, we can conclude from the relationship between students' use of laptop computers, their personal gender characteristics, and their behaviors in using distinct types of electronic devices before bedtime were correlated with sleep quality with statistically significant at level of 0.05.

6. Results of Analyzing the Difference in Sleep Quality Scores between Male and Female Students
The results of the analysis of the difference in the average sleep quality scores between male and female students obtained from the program are presented in **Table 11 and 12**.

Table 11: the mean and standard deviation of sleep quality scores for male and female students

Gender	Number	Mean	S.D.	Standard error of S.D.
Male	163	0.34	0.474	0.037
Female	591	0.20	0.404	0.017

(PSQI score <= 5 is good sleep quality which converted to be 1 while PSQI>5 is poor sleep quality converted to be 0)

Table 12: show the variance between sleep quality score groups and the difference in mean sleep quality scores

Sleep quality score	Equal Variance assumed	Equal Variance not assumed
Levene's Test for Equality of Variance	-	-
F-Test: F Value & (Sig.)	37.912 (< 0.001)	-
t-Test for Equality of Means	-	-
t-Test: t-Value & (Sig.) One-Side p	3.571 (< 0.001)	3.261 (< 0.001)
t-Test: t-Value & (Sig.) Two-Side p	3.571 (< 0.001)	3.261 (0.001)

The hypothesis testing for the difference in mean sleep quality scores between male and female students can be formulated as follows:

H_0 : The average sleep quality score of male students is less than or equal to that of female students.
H_1 : The average sleep quality score of male students is higher than that of female students.
H_0 : $\mu_1 - \mu_2 \leq 0$
H_1 : $\mu_1 - \mu_2 > 0$

From **Table 12**, the analysis of variance of the average sleep quality scores between male and female students shows that the F-value is 37.912, and the statistical significance (Sig.) is less than 0.001. This p-value is smaller than the predefined statistical significance level (α) in this research, which is 0.05. Therefore, we reject the null hypothesis (H0) and conclude that there is a statistically significant difference in the variance of sleep quality scores between male and female students.

When conducting a t-test (Equal Variance not Assumed to be applied) on the average sleep quality scores of male and female students, we obtained a t-value of 3.261 and a Sig. (1-Side) of less than 0.001. Based on this statistical analysis, we conclude that the average sleep quality score of male students is significantly higher than that of female students, with statistical significance at the 0.05 level.

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Referencing **Table 11**, we observe that the mean sleep quality score for male students is 0.34, while for female students, it is 0.20. **In conclusion, male students have a higher sleep quality than female students, with statistical significance at the 0.05 level.**

DISCUSSION

This research is a survey study aimed at investigating the electronic device usage behavior of high school students and its relationship with sleep quality. The objectives are as follows:

1. To compare the differences in the average time spent by students using distinct types of electronic devices
2. To examine the relationship between the average time students using each type of electronic device and sleep quality
3. To investigate the correlation between students' personal characteristics and sleep quality
4. To study the relationship between the average time students spend using distinct types of electronic devices before bedtime and sleep quality.
5. To explore the correlation between the total daily screen time for each type of electronic device and sleep quality
6. To analyze the differences in sleep quality scores between male and female students

The population for this research consists of children and adolescents aged 15-19 years in Bangkok, with a total population of 298,666 individuals. This population is further categorized into 151,633 males and 147,033 females, based on the population registration data for the 15-19 age group in the fiscal year 2023, provided by the Department of Provincial Administration, Ministry of Interior, Thailand.

As for the sample group in this research, there are 754 samples. This sample size is considered adequate for comparison when using the G*Power software, with a confidence level of 95% and a margin of error of ±5%, resulting in a required sample size of 654 samples.

The researcher analyzed the quality of the questionnaire regarding the items that use a Likert scale. To assess the reliability of the questionnaire, the researcher utilized the SPSS (Statistical Package for the Social Sciences for Windows) software. The analysis aimed to determine the consistency of the questionnaire items.

The analysis yielded a range of standard deviations (S.D.) between 0.763 and 1.585, indicating the variability in responses for these Likert scale items. Additionally, the Cronbach's Alpha Coefficient, which measures the internal consistency of the questionnaire, was found to be 0.554 or 55.4%. This coefficient reflects the degree to which the questionnaire items are correlated and suggests that the questionnaire has moderate internal reliability, with around 55.4% of the variance in responses being consistent among the items.

Data collection for this research involved the use of Google Forms distributed through the Line Application to a sample group aged between 15 and 19 years old in Bangkok. Respondents could answer the questionnaire from July 12th to 18th, 2023.

For questions related to personal status, frequency analysis was used to determine the distribution of responses.

To analyze behavior regarding the usage of various electronic devices throughout the day and before bedtime, Friedman's test was employed to compare mean ranks among several types of electronic devices. Pairwise differences were investigated using Z-tests and the Wilcoxon test.

Regarding the relationship between personal status (age 15-19) and sleep quality, a multiple correlation coefficient analysis was performed using regression analysis. The F-test examined the overall relationship, and pairwise differences were assessed using the t-test and Wilcoxon test.

Notably, significant differences in sleep quality scores were observed between male and female students, supported by F-statistics and t-statistics. All statistical analyses were conducted using the SPSS program.

CONCLUSION

In presenting the research findings, the researchers would like to provide an overview, and summarize the study's key conclusions in the following order:

1. The respondents in this study were students aged 15-19 years old in Bangkok, totaling 754 individuals. There were more female respondents (591, 78.4%) than male respondents (163, 21.6%)

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2. The usage patterns of various electronic devices, including television, personal computers (PCs), laptops, mobile phones, and tablets, differed significantly among students on a statistically significant level (α=0.05)
3. Among the daily electronic device usage behaviors of students, particularly regarding laptops, a statistically significant relationship between laptop and sleep quality was correlated significantly with a statistically significant of 0.05 level.
4. Personal characteristics, specifically gender, were found to have a statistically significant relationship with sleep quality among students with 0.05 level.
5. The use of electronic devices in the period before bedtime was also found to be significantly correlated with sleep quality with statistically significant of 0.05 level.
6. Sleep quality among male students was significantly better than that among female students with statistically significant of 0.05 level.

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