

# Factors predicting screen time related to physical and behavioural complaints in primary school children

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## ABSTRACT

**Background and objective:** Physical and behavioural problems from extended usage of electronic devices are issues among primary school children. This study is aimed to investigate the prevalence of physical and behavioural complaints arising from the electronic device usage and to identify the potential factors that predicted the complaints.

**Methods:** This was a primary school-based cross-sectional study using multistage cluster sampling, conducted at Bau district in Sarawak, Malaysia in 40 primary schools. A questionnaire was used to collect information of usage pattern in insufficient lighting, timing and position. The physical and behavioural complaints were traced. Data analysis was performed using SPSS version 22. A p-value < 0.05 with 95% CI was considered as statistically significant.

**Results:** About 52.8% of the 569 students used digital devices in a bright room, 69.8% in the day time and 54.4% in sitting position. The physical complaints were headache (32.9%), neck, shoulder and back pain (32.9%) followed by eye strain (31.8%). Regarding behavioural problems, 25.7% of the students had loss of interest in study and outdoor activities (20.7%), skipped meals (19.0%) and arguments/disagreements with parents (17.9%). After logistic regression analysis, the lying position (OR=1.71, 95% CI: 1.096, 2.688) and darkroom lighting (OR=2.323 95% CI: 1.138, 4.744) appeared to be potential predictors of the complaint.

**Conclusion:** One-quarter of the students studied experienced physical complaints, and one-fifth had behavioural problems associated with the use of electronic devices. Lying position and darkroom lighting are the potential predictors of complaints. Therefore, we suggest that the children should use electronic devices in the sitting position with adequate room lighting.

## KEYWORDS:

*Electronic devices, Complaint, screen time, logistic regression analysis*

## INTRODUCTION

It is increasingly common for present day children have grown up with electronic devices and this has become the

norm in many of the more affluent societies. Some caregivers may even use such electronic technology as an “*electronic pacifier*” to calm and entertain their kids. Nightly per cent of parents admitted that their children under the age of two were exposed to electronic media<sup>1</sup> and the majority of parents are widely unconcerned about the media usage of their young children.<sup>2</sup> Digital technology always raises concerns about a potential negative impact on the physical, cognitive, emotion and social well-being of the children.<sup>3,6</sup> There is evidence that excessive screen time is associated with a variety of health harms among children, with evidence strongest for an unhealthy diet, adiposity, depressive symptoms and quality of life.<sup>7</sup> Digital eye strain and behavioural stress from extended usage of electronic devices are some of the major issues that is raised among school children.

In this study, we aimed to estimate the prevalence of physical complaints and behavioural problems arising from the electronic device usage among primary school children and to identify the potential factors that predicted the physical-behavioural complaints due to usage of electronic devices.

## MATERIALS AND METHODS

### Setting and sample size

This was a school-based cross-sectional study conducted at Bau district in Sarawak, Malaysia. All the students of Bau district primary schools and school going children up to the age of 15 years old were eligible to be included in the study population. The study was conducted from May to November 2018. To determine the sample size, we used a single proportion sample size calculation with finite population correction and a 20% prevalence of refractive error.<sup>8,9</sup> We used 0.05 as an acceptable margin of error and a standard normal variate of 1.96. So, the initial sample size was 388. As we followed multistage cluster sampling, the sample size was multiplied by the design effect of 2.0 and then further inflated, incorporating 20% of the non-response rate. The final sample size was 930.

### Sampling procedure

We followed a multistage sampling technique to select the study participant. In the first stage, 40 government-funded primary schools were selected randomly from Bau district

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under the Kuching division. The list of all primary schools was obtained from Bau district education office which served as a sampling frame. The schools were categorised into 6 zones with total students of approximately five thousand. In the second stage, the desired number of classroom nested within the selected schools were selected randomly. Finally, the randomly selected students using a list of the selected class were invited to take part in the study.

### Instruments and data collection procedure

Data from children older than 12 were collected using a self-administered questionnaire. The interviewer-administered questionnaire was used for younger age children. Parents or caretakers would serve as a proxy respondent if the child was unable to provide the information. All responders were assisted by a researcher for the explanation of questions. Written informed consent and information sheets were distributed to the parents two weeks before the survey. The questionnaire was given out on the day of the study. Children whose parents had given their written consent were included in the study. The child with special needs, dyslexia and parents who opted-out of the study were excluded. A Malay version of the questionnaire was used for data collection, and the questionnaire was pre-tested before the final study.

### Measurements and operational definition

#### *Electronic devices*

In our study, the electronic devices include television, computer/laptop, tablet/iPad, smartphones, and handheld video game consoles. The choice of electronic devices among student was documented. The usage pattern in terms of usage in adequate lighting (bright or dim room), timing (daytime or night time) and position (sitting or lying down) were recorded.

#### *Complaints*

The responses of the respondents were divided into physical and behavioural complaints. The physical complaints were difficulty in falling sleep, headache, eye strain (tired or dry eye), joint/wrist pain, neck/shoulder/back pain. The behavioural complaints were loss interest in study, disagreements with parents, loss of interest in outdoor activities, skipping meals and holding the bladder or the urge to defecate following the usage of the electronic devices. The six options, ranging from never (0), very rarely (1), rarely (2), occasionally (3), frequently (4), very frequently (5), was used to assess the complaints of the students. For easy interpretation, never, very rarely and rarely were collapsed as 'zero' meaning no complaints and occasionally, frequently and very frequently as 'one' meaning having complaints.

#### *Statistical analysis*

Before entry of data into the computer, it was checked for any inconsistency and completeness. Firstly, a descriptive analysis with simple frequency, mean and standard deviation were presented. A stepwise forward and backward binary logistic regression analysis was done to determine the potential predictors of complaints about the use of electronic devices. In our study, each complaint from physical and behavioural type was initially coded as '0' as no and '1' as having complaints. Furthermore, all the positive complaints were

summed up. The students who had no complaints were coded as 'no' and one or more complaint was coded as 'yes'. All the statistical analysis was done by IBM SPSS version 22.0. A p-value is less than 0.05 considered statistically significant.

## RESULTS

### Demographic characteristics

A total of 569 students participated in this survey with a response rate of 73.3%. The mean age of the students was  $10.89 \pm 1.48$  Standard deviation years, with a minimum age of seven and a maximum age of 15 years. More than half (55.7%) were females, and male students (44.3%). The majority of the students were from the Bidayuh community (78.2%), and the rest were Chinese (8.1%) and Malays (6.7%), Iban and other ethnic groups (Table I). In terms of media usage pattern, 52.9% of the responders preferred using the devices in a bright room, 69.6% in the day time and 54.4% in sitting position. The children spent a total of 6.89 hours per day on screen time Table I. The children screen time on weekday was 5.45 hours per day as compared to 8.42 hours on weekend.

### Complaints due to usage of electronic devices

The most prevalent physical complaints were headache (32.9%), neck, shoulder, and back pain (32.9%) followed by eye stain (31.8%), difficulty sleeping (23.7%), holding bladder (15.6%) and joint pain (12.7%). Regarding behavioural problems, one-fourth of the students had a loss of interest in study (25.7%) followed by loss of interest in outdoor activities (20.7%), skipped meals (19.0%) and argued with parents (17.9%) Table II.

### Relationship between complaints with lighting, preferred time and position using electronic devices

Position when viewing screen devices was most statistically significant with the type of complaints. We found that lying down while using electronic devices will resulted in more disagreements with parents and skipped meals/drinks ( $p < 0.001$ ). Meanwhile, eye strain, loss interest in the study, and loss of interest in outdoor activities had p value of  $< 0.01$  Table III.

Our analysis also revealed a not statistically significant association between preferred time to use electronic device and complaints ( $p > 0.05$ ) except difficulty in sleep ( $p < 0.001$ ), headache ( $p < 0.05$ ) and holding bladder ( $p < 0.01$ ) Table III. That is those who use an electronic device at night time had complaints of difficulty in asleep, headache and holding bladder.

Bivariate analysis with a chi-square test of independence revealed that no statistically significant association was found between weekly screen time duration ( $p > 0.05$ ) with the complaints except difficult to sleep ( $p < 0.001$ ), and which is high among the students had weekly screen time duration more than 10 hours and above.

### Relationship between devices type and complaints

We found that 98.1% of the children were watching television followed by 78.9% using smartphones, laptops (30.4%),

**Table I: Characteristics of the students**

Characteristics	Frequency		%
Age		10.89 (±1.48) years	
Mean age (SD)			
Gender			
Male	252		44.3
Female	317		55.7
Ethnicity			
Bidayuh	445		78.2
Chinese	46		8.1
Malay	38		6.7
Iban	28		4.9
Others	12		2.1
Duration		6.89 (4.72) hours	
Screen time (mean Sd)			
Room lighting			
Bright room	301		52.9
Dark room	92		16.2
Both	176		30.9
Timing			
Day time	396		69.6
Night	173		30.4
Position			
Sitting	309		54.4
Lying	260		45.6

**Table II: Percentage distribution of students by complaints (n=569)**

Complaints	No		Yes	
	n	%	n	%
Physical health				
Headache	382	67.1	187	32.9
Neck, shoulder and back pain	382	67.1	187	32.9
Eye strain	388	68.2	181	31.8
Difficult to sleep	434	76.3	135	23.7
Holding bladder	480	84.4	89	15.6
Joints pain	497	87.3	72	12.7
Behavioural issue				
Loss interest in the study	423	74.3	146	25.7
Loss interest in outdoor activities	451	79.3	118	20.7
Skip meal/drink	461	81.0	108	19.0
Disagreements with parents	467	82.1	102	17.9

desktop computers (28.1%), tablets (26.2%) and 25.8% using a gaming consoles. However, most of the students were exposed to multiple electronic devices. In the analysis of relationship between device types and complaints, there was statistically significant association was found between gaming console with difficult to sleep ( $p=0.04$ ), loss interest in outdoor activities with the laptops ( $p=0.04$ ) and television with holding bladder ( $p=0.006$ ) (Table IV). We did not observe the relationship between screen devices size and distance of viewing with the complaints.

**Factors affecting the complaints due to the use of electronic devices: Binary logistic regression analysis**

The variables namely age, gender, ethnicity, duration of screen time, lighting, position, the timing of use of the electronic device are used as predictor variables in bivariate analysis. All the variables significant in bivariate analysis were entered into the stepwise binary logistic regression model. The model fitting information revealed that model chi-square (df) was 15.75(3) was statistically significant ( $p<0.0013$ ). The goodness of fit was not statistically

significant (chi-square (df)=5.43(2),  $p>0.05$ ) indicating well-fitted model. The predicted classification was 81.02%, i.e. the fitted model correctly classified in 81% cases and the area under the Receiver Operating Curve (ROC) was 0.62. The stepwise binary logistic regression analysis revealed that position and lighting of the room appeared to be potential predictors of complaint due to the use of electronic devices. The complaint was 1.72 times (95% CI: 1.096, 2.688) more likely to be higher among the students those who use the electronic devices in a lying position compared to the sitting position. The complaint was 2.32 times (95% CI: 1.138, 4.744) more likely to be higher among those who use it in the darkroom (Table V).

**DISCUSSION**

One-third of our primary school going aged children experienced physical complaints arising from electronic device usage. They suffered from neck, shoulder and back pain, headaches, and tired and dry eye after an extended period of screen time. Our analysis showed a relationship

Table III: Relationship between complaints with lighting, preferred time and position using electronic devices

Variables	n	Lighting			p-value	Preferred time		p-value	Position		p-value
		Bright (n=301)	Dark (n=92)	Both (n=176)		Day (n=396)	Night (n=173)		Sitting (n=309)	Lying down (n=260)	
Difficult to sleep											
No	434	55.5	15.7	28.8	0.069	73.0	27.0	0.001**	56.7	43.3	0.041*
Yes	135	44.4	17.8	37.8		58.5	41.5		46.7	53.3	
Eye strain											
No	388	56.7	13.1	30.2	0.005**	72.2	27.8	0.051	58.2	41.8	0.006**
Yes	181	44.8	22.7	32.6		64.1	35.9		45.9	54.1	
Headache											
No	382	51.8	17.0	31.2	0.676	72.3	27.7	0.049*	56.8	43.2	0.087
Yes	187	55.1	14.4	30.5		64.2	35.8		49.2	50.8	
Neck, shoulder and back pain											
No	382	56.3	16.5	27.2	0.021*	69.6	30.4	0.978	57.6	42.4	0.025*
Yes	187	46.0	15.5	38.5		69.5	30.5		47.6	52.4	
Joints pain											
No	497	52.9	16.1	31.0	0.992	70.4	29.6	0.260	56.3	43.7	0.011*
Yes	72	52.8	16.7	30.6		63.9	36.1		40.3	59.7	
Loss interest in the study											
No	423	54.1	15.4	30.5	0.540	71.2	28.8	0.168	58.2	41.8	0.002**
Yes	146	49.3	18.5	32.2		65.1	34.9		43.2	56.8	
Argument with parents											
No	467	54.8	16.1	29.1	0.101	71.3	28.7	0.058	59.3	40.7	0.001***
Yes	102	44.1	16.7	39.2		61.8	38.2		31.4	68.6	
Loss of interest in outdoor activities											
No	451	53.2	16.9	29.9	0.505	69.8	30.2	0.801	57.2	42.8	0.007**
Yes	118	51.7	13.6	34.7		68.6	31.4		43.2	56.8	
Skip meal/drink											
No	461	54.2	15.8	29.9	0.415	70.7	29.3	0.230	57.7	42.3	0.001***
Yes	108	47.2	17.6	35.2		64.8	35.2		39.8	60.2	
Holding bladder											
Yes	480	53.5	15.6	30.8	0.667	71.9	28.1	0.006**	55.0	45.0	0.440
No	89	49.4	19.1	31.5		57.3	42.7		50.6	49.4	

p-value reached from chi-square test

\*p<0.05; \*\*p<0.01; \*\*\*p<0.001

between complaints of tired or dry eye with dark lighting room ( $p=0.005$ ) and lying position ( $p=0.006$ ). The dry eye symptom is probably due to a reduced blink rate and amplitude with persistent corneal exposure to digital monitors. Studies have revealed that the prevalence of visual symptoms was higher among users who spend more than four hours working on a video display terminal.<sup>10,11</sup>

Previous studies have observed associations between screen time exposure and headaches in children and adolescents.<sup>12-15</sup> The headache is often caused by eye strain, screen glare, poor lighting, excessive electronic devices brightness and poor posture. Children in our study experienced headache when using the electronic gadget at night time ( $p=0.049$ ) but not significant when in poor posture ( $p>0.05$ ).

Adequate sleep is an essential part of child development of learning, memory, emotion and behaviour. The emerging screen time hampered the quality of sleep by shortened sleep duration and later bedtimes.<sup>16</sup> Electronic devices emission bright light can increase alertness and disrupt the body naturally occurring circadian rhythm by suppressing melatonin release.<sup>17-18</sup> Screen time can cause poor sleep outcomes, including delayed bedtimes, shortened total sleep time, and caused daytime tiredness. Our analysis also

showed that the children suffered from difficulty in sleeping when using an electronic device at night time ( $p=0.049$ ) and with the lying position ( $p<0.05$ ).

Some studies reported a positive association of screen time with behavioural issues among children.<sup>7,19-21</sup> Excessive screen time in childhood is associated with irritability, low mood and sleeping problem, which leads to poor academic performance.<sup>22</sup> One-fourth of our students had societal issues like loss of interest in the study ( $p<0.01$ ), disagreements with parents ( $p<0.001$ ), loss of interest in outdoor activities ( $p<0.01$ ), and skipping meals ( $p<0.001$ ) with the lying down position when using electronic devices.

The main limitation of this study was information bias. The self-reported responses to the questionnaires can be subjective and might vary from student to student. For our younger aged children, we adopted the interviewer-administered and parent-administered questionnaire as a proxy. There might be a discrepancy in the information given by children and parents. People usually use the device in varied places, in multiple times, and varying positions; as a result, the complaints vary from a different perspective. However, we did not determine the correlation of complaints with these variables.

**Table IV: Relationship between devices uses and complaints**

Complaints		n	TV		PC		Laptop		Tablet		Smartphone		Console	
			No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Difficult to sleep	No	434	1.6	98.4	72.8	27.2	71.4	28.6	74.2	25.8	22.6	77.4	76.3	23.7
	Yes	135	3.0	97.0	68.9	31.1	63.7	36.3	72.6	27.4	16.3	83.7	67.4	32.6
	p-value		0.320		0.376		0.088		0.712		0.118		0.040*	
Tired or dry eye	No	388	2.1	97.9	72.4	27.6	70.4	29.6	74.5	25.5	21.4	78.6	73.5	26.5
	Yes	181	1.7	98.3	70.7	29.3	68.0	32.0	72.4	27.6	20.4	79.6	75.7	24.3
	p-value		0.744		0.674		0.561		0.594		0.796		0.570	
Headaches	No	382	2.4	97.6	72.8	27.2	68.8	31.2	72.0	28.0	21.7	78.3	72.8	27.2
	Yes	187	1.1	98.9	70.1	29.9	71.1	28.9	77.5	22.5	19.8	80.2	77.0	23.0
	p-value		0.950		0.498		0.580		0.157		0.594		0.279	
Neck, shoulder and back pain	No	382	1.6	98.4	70.4	29.6	69.1	30.9	73.0	27.0	22.0	78.0	73.8	26.2
	Yes	187	2.7	97.3	74.9	25.1	70.6	29.4	75.4	24.6	19.3	80.7	74.9	25.1
	p-value		0.396		0.268		0.719		0.547		0.452		0.789	
Joint pain	No	497	2.0	98.0	72.4	27.6	70.4	29.6	73.2	26.8	21.7	78.3	74.6	25.4
	Yes	72	1.4	98.6	68.1	31.9	63.9	36.1	77.8	22.2	16.7	83.3	70.8	29.2
	p-value		0.720		0.440		0.260		0.413		0.325		0.490	
Loss interest in study	No	423	1.2	98.8	70.2	29.8	68.1	31.9	72.6	27.4	21.3	78.7	73.8	26.2
	Yes	146	4.1	95.9	76.7	23.3	74.0	26.0	77.4	22.6	20.5	79.5	75.3	24.7
	p-value		0.027		0.132		0.182		0.253		0.852		0.706	
Disagreements with parents	No	467	1.7	98.3	71.5	28.5	68.1	31.9	74.5	25.5	21.8	78.2	74.1	25.9
	Yes	102	2.9	97.1	73.5	26.5	76.5	23.5	70.6	29.4	17.6	82.4	74.5	25.5
	p-value		0.414		0.683		0.096		0.413		0.347		0.930	
Loss interest in outdoor activities	No	423	1.2	98.8	70.2	29.8	68.1	31.9	72.6	27.4	21.3	78.7	73.8	26.2
	Yes	118	1.7	98.3	76.3	23.7	80.5	19.5	76.3	23.7	22.9	77.1	72.9	27.1
	p-value		0.833		0.233		0.004**		0.496		0.592		0.720	
Skipping meals/drinks	No	461	2.0	98.0	71.4	28.6	68.1	31.9	74.4	25.6	20.2	79.8	74.4	25.6
	Yes	108	1.9	98.1	74.1	25.9	75.9	24.1	71.3	28.7	25.0	75.0	73.1	26.9
	p-value		0.946		0.573		0.114		0.509		0.268		0.788	
Holding bladder	No	480	1.3	98.8	71.9	28.1	70.6	29.4	75.2	24.8	20.0	80.0	74.8	25.2
	Yes	89	5.6	94.4	71.9	28.1	64.0	36.0	66.3	33.7	27.0	73.0	70.8	29.2
	p-value		0.006**		0.995		0.215		0.076		0.139		0.428	

\*p<.05, \*\*p<.01, \*\*\*p<.001, The p-value obtained from Chi-square test

**Table V: Factors affecting the complaints due to the use of electronic devices: Binary logistic regression analysis (n=569)**

Parameters	Adjusted Odds ratio with 95% CI	SE	p-value
Position			
Sitting (RC)	1.00		
Lying down	1.72 (1.1, 2.69)	0.40	0.02
Room lighting			
Lighted room (RC)	1.00		
Darkroom	2.32 (1.14, 4.74)	0.85	0.02
Both (bright and darkroom)	1.54 (0.94, 253)	0.39	0.09
Constant	2.71 (2.01, 3.65)	0.41	P<0.001

Eliminated variables: age, gender, ethnicity, duration of screen time and timing of use of the electronic device  
RC= Reference category

**CONCLUSION**

One-quarter of our primary school going children experienced physical complaints, and one-fifth of them had a behaviour issues after the use of electronic devices. Lying position and dark lighting of the room appeared to be potential predictors of the complaint. Therefore, we would like to suggest that the children should use electronic devices in the sitting position and with adequate room lighting to avoid the physical and behavioural issues.

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**ETHICS APPROVAL**

The Medical Ethics Committee, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak (02/2018) approved the study. An approval from the Ministry of Education Malaysia KPM.600-3/2/3-eras(1022) was also obtained.

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**CONFLICT OF INTEREST**

The authors have no potential conflict of interest to declare

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