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The Effect of Gadget Usage Duration on Cognitive Function with MMSE in SMPN 2 Students in Koba District, Bangka Belitung Islands

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ABSTRACT

Gadgets as technological tools with its various conveniences are currently considered important in everyday life. The use of gadgets for a long duration time can interfere children's learning ability, reduce interaction with the surrounding environment and can reduce attention, resulting in impaired cognitive function's development. This study aims to determine the relationship of gadget usage duration to the development of cognitive function. This is a descriptive analytic, cross-sectional study, which was conducted on SMPN 2 Koba students totaling 72 students. The SAS-SV questionnaire was used to determine the gadget usage duration (categorized as light, medium and heavy) and the MMSE questionnaire to examine cognitive function (categorized as normal and impaired cognitive function). The results showed that more than half of the subjects (56.9%) cognitive impairment and most (51.4%) were heavy gadget users. There is a significant relationship between the length of device use and the development of cognitive function (p=0.000). As a conclusion, the longer duration of gadget usage, the greater the possibility of impaired development of cognitive function

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1. INTRODUCTION

Gadgets are currently devices with various advantages, especially its facility compared to other technologies. Some examples of gadgets are cellphones, computers, laptops and iPads. Various age groups use gadgets, from children to adults. The purpose is to communicate, as information media, and entertainment. Despite the fact that it has various advantages, the use of gadgets in longer duration time and for bad intention (such as playing games, watching movies containing violent and sexual elements), can have a negative impact on children's daily thinking and behavior patterns.[1] The duration of device use can be measured using the Smartphone Addictions Scale-Short Version (SAS-SV) questionnaire and the results are categorized as mild, moderate and severe. The SAS-SV questionnaire was also used to assess the level of device dependence, anxiety, and decreased attention.[2]

According to Kominfo survey on device ownership in 2017, based on education's level, the elementary school education were 40.87%, junior high school were 59.89%, high school were 79.56%, diploma / S1 were 93% and S2 / S3 were 100%. When categorized by age group, the majority (65.34%) are between 9-19 years old. The devices are used for various purposes, including for communication (93.46%,) entertainment media (games) (65.29%) and for learning (27.51%). The use of devices for communication and entertainment is higher than for learning.[3]

Heavy use of gadgets can cause an increase in the neurotransmitter GABA in the brain, resulting in an inhibition or slowing of signal transmission in the brain. This can cause obstacles to regulate various brain functions, for instance sensory-motor and anxiety, thus disrupting the development of cognitive functions.[4] The development of cognitive functions according to Piaget, children aged ≥12 years has entered formal operational stage, where the child no longer needs help to use concrete objects or to think. The ability to abstract thinking begins to develop and cognitive function at this age is needed to improve brain's capability. Cognitive function is an aspect of a

person's development that includes mental abilities and activities which related to the process of receiving, processing, storing and using information in the form of thinking, problem solving, and its adaptation.[5]

Various studies on the effect of gadgets on cognitive function have been conducted. Manggena's research (2017) state that the development of cognitive function can be influenced by the intensity of device use of more than 3 hours / day.[6] Other researches also showed that the development of cognitive function can be influenced by the intensity of high device use and the use of annoying applications.[7], [8]

Ma'ani (2016) states that the development of cognitive function can be influenced by socioeconomic and poor nutritional status. Development of cognitive function can be assess through several tests, including the Mini Mental State Examination (MMSE) questionnaire. Mini Mental State Examination is a practical and effective questionnaire used to assess a person's cognitive function, which consists of 5 components, including orientation, registration, attention, memory and language.[9]

2. METHOD

This study is a cross-sectional descriptive analytic study that aims to describe the relationship between duration of gadget usage on cognitive function. The research was conducted at SMP 2 Koba, Bangka Belitung. Data was collected by interview and questionnaires. The SAS-SV questionnaire used to assess the risk of attention disturbance due to device usage and the MMSE questionnaire to assess cognitive function. Data collection was carried out during August - December 2021 and obtained 72 subjects according to the inclusion and exclusion criteria. The data will be investigated with univariate and bivariate analysis, and processed using SPSS ver. Univariate analysis consists of sample characteristics, description of length of device use, description of cognitive function, and description of risk of device users, while bivariate analysis is assessing the relationship between length of device use and cognitive function.

3. RESULTS AND DISCUSSION

Subjects Characteristics

Based on gender, most were female (41.7%) and the majority were 13 years old (61.1%) (Table 1). Based on the length of device use, the majority (45.9%) were heavy users (≥ 5 hours per day). Only 19.4% used devices <5 hours per day.

Table 1. Subject Characteristics (n=72)

Characteristics	Total	Percentage
Gender		
• Male	30	41.7
• Female	42	58.3
Age		
• 12	20	27.8
• 13	44	61.1
• 14	8	11.1
Length of use (per day)		
• Mild (<5 hours)	25	34.7
• Medium (5 hours)	14	19.4
• Heavy (≥5 hours)	33	45.9
Cognitive function (MMSE score)		
• Normal (24-30)	31	43.1
• Moderate impairment (17-21)	33	45.8
• Severe impairment (0-17)	8	11.1
Risk of device use (SAS-SV)		
• Low risk	67	93.1
• High risk	5	6.9

Assessment of cognitive function impairment using the MMSE questionnaire. The study found that more than half (56.9%) had cognitive impairment, which was divided into moderate (45.8%) and severe impairment (11.1%). From the risk status of gadget usage, the majority (93.1%) of subjects are still at mild risk. In this study, we found that the age of most device users was ≥12 years old. Children aged ≥12 years have entered the junior high school stage and puberty. From a social point of view, children's dependence on both parents has begun to disappear and their hang out more with their peer-group.[10] Based on gender, there are more females than males. This is because in general, in SMPN 2 Koba female students predominantly, so more female samples are obtained. As mentioned by Mawarpury (2020), female use devices more than men. This is because women prefer to access the internet for various purposes such as searching for information, communication, and entertaining.[2]

The results of the length of device use are divided into 3 categories, light (<5 hours/day), medium (5 hours/day), high (>5 hours/day). As stated by Subarkah (2019), longer than 5 hours device usage can have a positive impact, for instance, it helps in learning foreign language, as a tools for searching information and communication, as well as to playing games.[1] However, as mention in Irfan's study (2020), excessive device use (>5 hours / day) can lead to several negative impacts, including health problems, irregular sleep time, reduces meal frequency and sedentary life style. All of which can ultimately interfere with the cognitive functional development.[7], [11]

Relationship Between Gender And Cognitive Function

Table 2. shows that there are more male subjects experiencing a decrease cognitive function (29.2%) compared to female (27.8%). The results of bivariate analysis using the Chi-square test found no significant relationship between gender and cognitive function (p=0.059).

Table 2. Relationship Between Gender And Cognitive Function

Gender	Cognitive Function		Total	p Value
	Normal	Decreased Cognitive Function		
Male	9 (12.5%)	21 (29.2%)	30 (41.7%)	0.059
Female	22 (30.5%)	20 (27.8%)	42 (58.3%)	
Total	31 (43.1%)	41 (56.9%)	72 (100%)	

Based on the results of the device usage risk from the SAS-SV questionnaire, the risk is categorized into high and low. Subjects are categorized as high risk, if the final score value is more than 31 for male and more than 33 for female. As mentioned in Mawarpury's study (2020), person with high risk can suffer from gadget dependency, so they will find it difficult to concentrate or focus on something due to being distracted by gadgets. The opposite happens for low-risk subjects. In this study, the subjects are still at low risk.[2]

The Relationship Between Gadget Usage Risk and Cognitive Function

The relationship between gadget usage risk on cognitive function can be seen in Table 3. Total of 56.9% subjects had impaired cognitive function. After bivariate analysis with Chi-square test, the p value obtained was 0.886. This indicates that there is no significant relationship between gadget usage risk and cognitive function impairment in SMP 2 Koba's student. Odds ratio value gadget usage risk is 1.145 times affect cognitive function.

Tabel 3. Relationship Between Risk of Gadget Usage And Cognitive Function

SAS-SV Questionaire	Cognitive Function			p Value	Odds Ratio
	Normal	Decreased Cognitive Function	Total		
Low Risk	29 (40.3%)	38 (52.8%)	67 (93.1%)		
High Risk	2 (2.8%)	3 (4.1%)	5 (6.9%)	0.886	1.145
Total	31 (43.1%)	41 (56.9%)	72 (100%)		

The cognitive function based on MMSE results is categorized into normal, moderate cognitive impairment and severe cognitive impairment. In this study, more than half of subjects had cognitive impairment. Ma'ani (2015) in their study showed that the MMSE test can be used to determine any disturbances in the development of cognitive function in children. Cognitive function is influenced by

various factors, including environmental factors, biological factors. She is also reported that that poor nutritional status can hinder nerve development in the brain and addiction to games or devices can cause a cognitive function impairment.[9] In this study, it is not known whether other factors associated with decreased cognitive function because no other information was collecting regarding this matter. This study was conducted to determine the relationship between duration of gadget usage on cognitive function. Bivariate analysis shows that there is a significant relationship between the duration and cognitive function. As indicated in Nurita's study, development of cognitive function can be influenced by the length of use of gadgets and the use of applications. [7] From the MMSE questionnaire, it is noted that the most cognitive function components that decline are attention, memory, and orientation. Attention reduction due to long time usage of device, leads to anxiety and reducing cognitive function. Study by Lee, indicate that device addiction leads to elevation of GABA neurotransmitter in the brain, which then inhibit or decelerate the brain signal transmission. This will obstruct the regulation of various brain functions, including sensory-motor, cognitive function, and even anxiety.[4] As demonstrated by Stahl in his research, anxiety leads to memory and attentional abilities problems, because person tends to think about the gadgets and have desire to be connected to it all the time.[12] Lack in social connection or communication with other people in surrounding environment is a sign of declining orientation abilities.[13] [14] A persons will no longer realize what happened and recognize other people in their environment.

The Relationship Between Screen Time And Cognitive Function

Table 4 showed that subjects who use gadgets more than 5 hours / day have the highest cognitive function impairment, as many as 29 subjects (51.4%). Bivariate analysis using the *chi square* test was conducted to see the relationship between the use of gadgets on cognitive function (p = 0.000). Thus this indicating that there is a significant relationship between the length of device use on cognitive function in the subject.

Table 4. Relationship Between Duration of Gadget Usage And Cognitive Function

Duration of Gadget Usage per Day	Cognitive Function			p Value
	Normal	Decreased Cognitive Function	Total	
Mild (< 5 Jam)	21 (29.1%)	4 (5.6%)	25 (34.7%)	0,000
Moderate (5 jam)	6 (8.3)	8 (11.1%)	14 (19.4%)	
Severe (≥ 5 Jam)	4 (5.6%)	29 (51.4%)	33 (65.3)	
Total	31 (43.1%)	41 (56.9%)	72 (100%)	

In regard to bivariate analysis results, there is no significant relationship between the risk of using gadgets on cognitive function. This is due to SAS-SV questionnaire can only determine disturbances in attention's aspect, while cognitive function disorders can only be assessed using MMSE questionnaire. The results of the SAS-SV questionnaire indicate that most students have low risk. In accordance with the Mawarpury's research (2020), low-risk students have not experienced dependence on gadgets, and only experienced a low decrease in attention.[2]

This study did not find a significant relationship between gender and cognitive function. However, the results showed that men experienced more decline in cognitive function than women. This is in accordance with Arnani's study which showed that internet addiction is higher in men than women.[15] The purpose of male students using devices is for entertainment media such as playing games. Curiosity to complete various stages of game their play, as quick as possible, leading to an increase in the amount of time their spent with gadgets. Games have been mentioned in various studies as a cause of addiction. Addiction is significantly associated with poor self-rated health, unhappiness and decreased cognitive function.[16] There is a significant relationship between the length of device use and cognitive function in this study. However, there was no significant relationship between cognitive function with gender and risk of device usage. Limitations of this study are the limited sample size and subject's interview held in open space, so it can cause bias during interviews and filling out questionnaires.

4. CONCLUSION

Gadgets are one example of technological advancements. Gadgets of many kinds, such as laptops and smartphones, are indispensable in today's world. Not only do adults use devices, but children do as well. Both good and bad effects of gadgets can be shown in children's development, particularly in their cognitive growth. When used appropriately and in accordance with usage guidelines, gadgets can positively impact children's development. However, when parents do not provide supervision, children may develop a dependence on gadgets that hinders their ability to learn and interact with their surroundings, leading to suboptimal child development.

We can therefore draw the conclusion that adult supervision is crucial to children's especially when using gadget, because the longer the screen time, the greater the likelihood of impaired cognitive function.

REFERENCES

[1] M. A. Subarkah, "PENGARUH GADGET TERHADAP PERKEMBANGAN ANAK," *Rausyan Fikr : Jurnal Pemikiran dan Pencerahan*, vol. 15, no. 1, Feb. 2019, doi: 10.31000/rf.v15i1.1374.

[2] M. Mawarpury, "KECENDERUNGAN ADIKSI SMARTPHONE DITINJAU DARI JENIS KELAMIN DAN USIA," *Psikoislamedia : Jurnal Psikologi*, 2020, [Online]. Available: https://api.semanticscholar.org/CorpusID:229438348

[3] A. Finaka, "66,3% masyarakat Indonesia Memiliki Smartphone #8," https://indonesiabaik.id/infografis/663-masyarakat-indonesia-memiliki-smartphone-8.

[4] Y.-H. Lee, C.-H. Ko, and C. Chou, "Re-visiting Internet Addiction among Taiwanese Students: A Cross-Sectional Comparison of Students' Expectations, Online Gaming, and Online Social Interaction," *J Abnorm Child Psychol*, vol. 43, no. 3, pp. 589–599, Apr. 2015, doi: 10.1007/s10802-014-9915-4.

[5] N. N. Rohmah, M. D. Wilandari, and Darsinah, "Teori Perkembangan Jean Piaget dan Implikasinya Dalam Perkembangan Anak Sekolah Dasar," *Jurnal Ilmiah Wahana Pendidikan*, vol. 8, no. 12, pp. 230–239, Aug. 2022.

[6] T. F. Manggena, K. P. Putra, and T. P. Elingsetyo Sanubari, "PENGARUH INTENSITAS BERMAIN GAME TERHADAP TINGKAT KOGNITIF (KECERDASAN LOGIKA-MATEMATIKA) USIA 8-9 TAHUN," *Satya Widya*, vol. 33, no. 2, pp. 146–153, Dec. 2017, doi: 10.24246/j.sw.2017.v33.i2.p146-153.

[7] D. A. Nurita, "Peran Penggunaan Gawai Pada Perkembangan Kognitif Anak Usia Dini," Institut Agama Islam Negeri Purwokerto , Purwokerto, 2021. Accessed: Dec. 02, 2023. [Online]. Available: https://repository.uinsaizu.ac.id/10773/1/Dwi%20Asalia%20Nurita_Peran%20Penggunaan%20Gawai%20pada%20Perkembangan%20Kognitif%20Anak%20Usia%20Dini%20%28Analisis%20Systematic%20Literature%20Review%29.pdf

[8] T. F. Manggena, "Pengaruh Intensitas Bermain Game terhadap Tingkat Kognitif (Kecerdasan Logika-Matematika) Usia 8-9 Tahun," Universitas Kristen Satya Wacana, Salatiga, 2017. Accessed: Dec. 02, 2023. [Online]. Available: https://repository.uksw.edu//handle/123456789/15936

[9] F. Ma'ani, E. Fadlyana, and S. E. Rahayuningsih, "Hubungan Kadar Feritin Serum dengan Fungsi Kognitif Berdasarkan Pemeriksaan Status Mini-Mental (MMSE) pada Penyandang Thalassemia Anak," *Sari Pediatri*, vol. 17, no. 3, p. 163, Nov. 2016, doi: 10.14238/sp17.3.2015.163-8.

[10] W. N. Wendari, A. Badrujaman, and A. Sismiati S., "PROFIL PERMASALAHAN SISWA SEKOLAH MENENGAH PERTAMA (SMP) NEGERI DI KOTA BOGOR," *INSIGHT: JURNAL BIMBINGAN KONSELING*, vol. 5, no. 1, p. 134, Jan. 2016, doi: 10.21009/INSIGHT.051.19.

[11] I. Irfan, A. Aswar, and E. Erviana, "HUBUNGAN SMARTPHONE DENGAN KUALITAS TIDUR REMAJA DI SMA NEGERI 2 MAJENE," *Journal of Islamic Nursing*, vol. 5, no. 2, p. 95, Dec. 2020, doi: 10.24252/join.v5i2.15828.

[12] L. Stahl, "Smartphone presence and its impact on cognitive impairment," University of Basel, Basel, 2018. Accessed: Dec. 02, 2023. [Online]. Available: http://mmi-basel.ch/MA/2018_Stahl.pdf
[13] R. F. Ghanang, "Analisis Dampak Game Online Pada Interaksi Sosial Anak Di Sd Mintaragen 3 Kota Tegal," Universitas Negeri Semarang, Semarang, 2020. Accessed: Dec. 02, 2023. [Online]. Available: http://lib.unnes.ac.id/39305/1/1401416430.pdf
[14] A. Sopyan, Arfan, and D. Mursyidah, "After the Signal Came: Changes in Behavior of Village Teens Using Gadget in Hulu Jambi," *International Journal of Social Science Review*, vol. 1, no. 2, Oct. 2020.
[15] N. P. R. Arnani and F. H. Husna, "PERBEDAAN KECENDERUNGAN ADIKSI GADGET SISWA SEKOLAH DASAR DITINJAU DARI JENIS KELAMIN," *Psycho Idea*, vol. 19, no. 1, p. 57, Feb. 2021, doi: 10.30595/psychoidea.v19i1.7489.
[16] I. Paridawati, M. I. Daulay, and R. Amalia, "PERSEPSI ORANGTUA TERHADAP PENGGUNAAN SMARTPHONE PADA ANAK USIA DINI DI DESA INDRASAKTI KECAMATAN TAPUNG KABUPATEN KAMPAR ," *Journal on Teacher Education* , vol. 2, no. 2, 2021.