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Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

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Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

Abstract

As technology advances and becomes more innovative, electronic media have become more commonplace in daily life. Studies have revealed a growing trend in Hong Kong's children's use of electronic media recently, considering the social segregation brought about by the COVID-19 outbreak, which has forced students to attend school at home. As a result, children in Hong Kong are becoming more accustomed to using electronic media and are exhibiting a youthful trend. Nonetheless, children's cognitive development and ability may be significantly impacted by this occurrence in Hong Kong. Thus, the current study's goal is to examine how electronic media affects Hong Kong children's cognitive development, with a particular focus on children in Hong Kong.

Moreover, this study examines pertinent national and international research first before summarizing the findings about how electronic media affects kids' cognitive development. Then I used a questionnaire survey methodology to gather information on the electronic media usage of 52 children in Hong Kong near local schools. Also, I used the SPSS analytical methodology, which includes frequency analysis and correlation analysis, during the data analysis process since the results indicate that there are some correlations between children's cognitive development and their use of electronic media. The study's conclusions also have implications for the family and educational environments in the Hong Kong area. It offers pertinent direction and advice and aids educators and parents in comprehending the effects of electronic media on kids' cognitive development.

However, there are still some limitations, including sample representation issues and the limitations of resources and time. So, the research still lacked representativeness and did not reflect all the children in Hong

Kong's use of electronic media and its effects on children's cognitive development more accurately. In conclusion, this study aims to establish a foundation for future research and practice in related sectors while offering a preliminary understanding of the influence of electronic media on children's cognitive development in Hong Kong.

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Chapter 1: Introduction

The aim of this study is to explore the impact of electronic media on the cognitive development of children in Hong Kong. This chapter is divided into three sections. The first section describes the background and motivation of the research, the second describes the research purpose, and the third section describes the research questions.

Section 1: Background and motivation

Firstly, Article 1 of 'The Convention on the Rights of the Child' defines a child as a person below the age of 18 (United Nations, 1989). Therefore, the aim of this study is to study the impact of electronic media on the cognitive development of children under the age of 18 in Hong Kong.

According to a report from the United Nations Children Fund, it is estimated that 1/3 of Internet users around the world are children and adolescents under 18 years old. Children are accessing the internet at increasingly younger ages. In addition, like globalization and urbanization, 'Digitalization' has already changed the world. For many children today, various electronic media (including TV, electronic game console, computer, iPad, and smartphone) have become part of everyday life. (Department of Health, 2019), and smartphones are fueling a 'Bedroom Culture' that children can use online in the privacy of their bedrooms without parental supervision or restriction.

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Electronic media use among children in Hong Kong

Before 2019

Table 1: Usage pattern of different electronic screen media among preschool children, 2017 and 2014

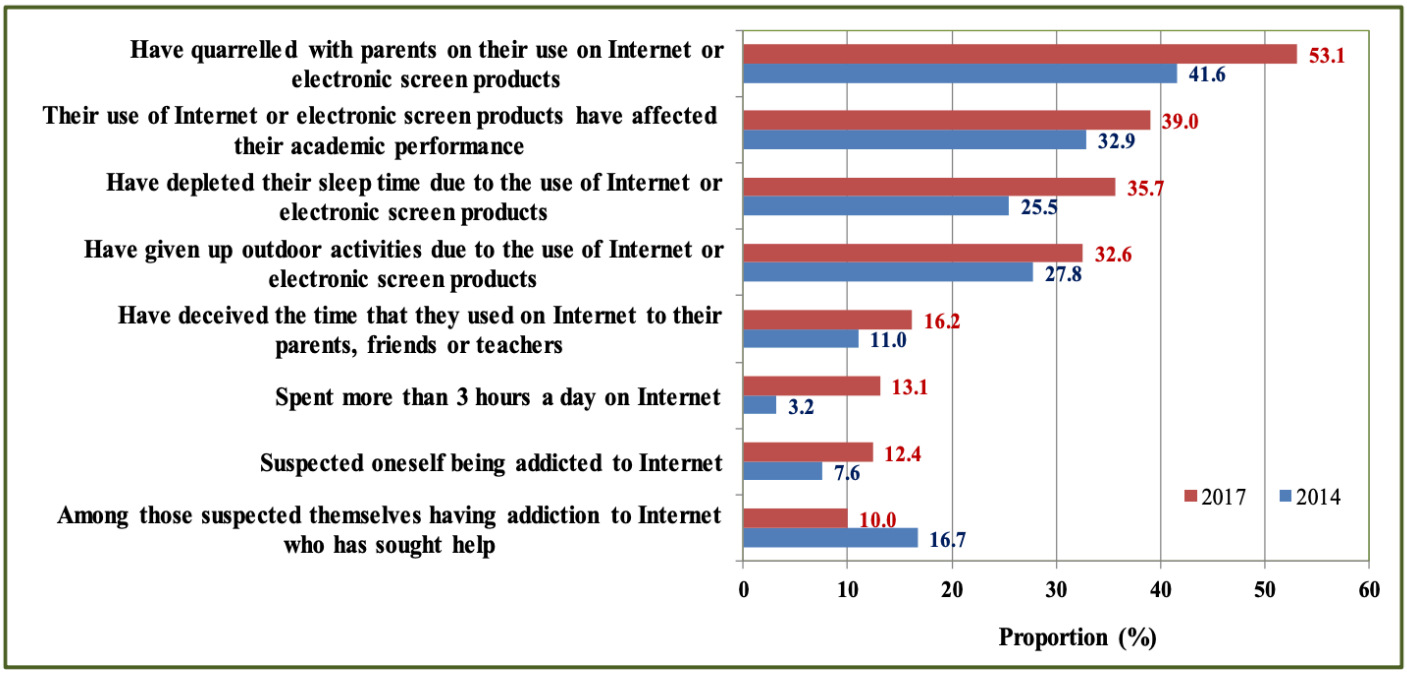
Type of electronic screen media	Prevalence of use (%)		Median age of starting to use (months)		Average viewing time per day (minutes)	
	2017	2014	2017	2014	2017	2014
TV	73.5	78.4	12	8	38.4	44.2
Smartphone*	43.7	*	12	*	25.6	*
Tablet	24.9	38.4	18	16	34.2	31.6
DVD	14.2	44.4	12	10	33.0	38.8
Computer	10.7	33.6	24	24	27.8	31.8

Note: * Not specifically asked in 2014.
Source: Family Health Service, Department of Health.

Preschoolers

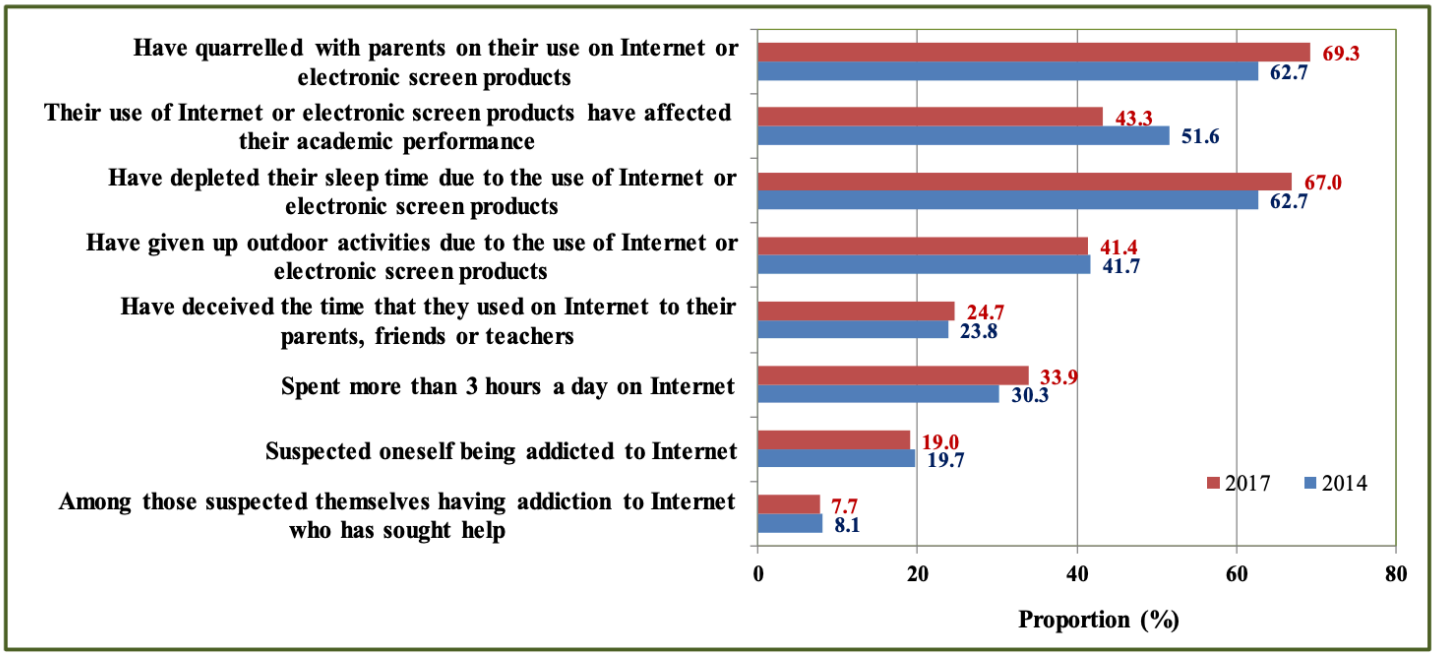
From Table 1. The electronic media most used by preschool children are televisions (73.5%) and smart phones (43.7%). These two electronic media are also the ones with the youngest age and the longest usage time. Among them, only a few parents often accompany their young children to use computer, iPad, and smart phone—only 6.2%, 11.1%, and 19.6%, respectively.

Figure 2: Issues associated with the use of Internet or electronic screen products as claimed by the surveyed primary school students, 2017 and 2014



Source: Student Health Service, Department of Health.

Figure 3: Issues associated with the use of Internet or electronic screen products as claimed by the surveyed secondary school students, 2017 and 2014



Source: Student Health Service, Department of Health.

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Primary and secondary school students

As shown in Figures 2 and 3, the impact due to the use of electronic media is also increasing. For example: arguments with parents, decreased academic performance, reduced sleep time, and giving up on outing activities.

After 2019

Figure 4

	平日使用時間（非學習/工作用途）	假日使用時間（非學習/工作用途）
家長	3.0小時	3.3小時
小學生	4.0小時	6.0小時
初小（小一至小三）	3.4小時	5.0小時
高小（小四至小六）	5.2小時	8.2小時

Primary school students spend an average of 4.6 hours a day using electronic media for non-study purposes. These figures are significantly higher than the guidelines recommended by the Center for Health Protection (primary school students should not use electronic media for more than two hours a day for entertainment purposes).

From the above data before and after 2019, it can be concluded that children's use of electronic media will cause different problems, such as reduced academic performance (learning), reduced sleep time (attention), and so on, which will have an impact on children's cognitive development. Also, there are many different types of

cognitive processes. They include attention, language, learning, memory, and perception (obtaining information through the senses and then using this information to react and interact with the world—executive abilities) (Kendra, 2023).

Therefore, as technology continues to develop and innovate, this study aims to explore the impact of electronic media on the cognitive development of children in Hong Kong. Through the current situation of children's use of electronic media, we can understand the frequency, habits, and patterns of Hong Kong children's current use of electronic media, as well as their impact and correlation with different abilities in cognitive development. I will also analyze and think about future trends and challenges, and I will also provide effective suggestions to help children grow up healthy.

Section 2: Research Purposes

Based on the above research motivations, the researcher proposes the following research purposes:

- Understand the status and habits of children's using electronic media in Hong Kong.
- Understanding the impact of electronic media use on the cognitive development
- Understand and analyze the relationship between the use of electronic media and cognitive development.

Section3: Research Questions

To achieve the above research objectives, this study proposes the following research questions:

- What is the frequency, habits, and patterns of Hong Kong children's use of electronic media current?
- Which type of cognitive abilities are the most affected by electronic media?
- What are the relationships between the age, time of use electronic media, family factors and cognitive development abilities?

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Chapter2: Literature review

This chapter aims to explore the relevant literature on the impact of electronic media on the children's cognitive development. The whole chapter is divided into three sections. This chapter explains the definition of cognitive development and related research on electronic media and cognitive development.

Section 1: Definition of Electronic Media and Cognitive Development

From using the electronic media including television, video game consoles, computer, iPad and smart phone (Department of Health, 2019). It will affect the cognitive development of children, including attention, language, learning, memory, and perceptual- executive abilities (Kendra, 2023), causing both positive and negative impacts.

Section 2: Research on electronic media and cognitive development

2.1 Research on using electronic media and attention development

Negative impact

Figure 5

First, in terms of brain function and structure, Dr. Andy Lee, who is a functional cranial neurology and chiropractor neurologist, mentioned in his book "A Complete Strategy for the Development of Children's Left and Right Brains". When children use electronic media, only the visual and motor cortex areas are used in the brain, whereas parts of the frontal lobe are used rarely. However, the frontal lobe in the brain mainly controls our thoughts, behavior, emotion and attention (Li Xianyan, 2012). Therefore, if children use electronic media for a long time, it means that they will be unable to train the functions of the frontal lobe in the brain, including attention. On the contrary, the visual and motor areas would be used and trained more, causing the children's body to be more active and their concentration to decrease naturally.

In addition, the impact of children's use of electronic media is far greater than imagined in their attention. The University of Bristol surveyed 1,013 children with an average age of 10, with parents filling out the questionnaire. The research results have found that even when parents try to give them physical activity time, children who spend too much time watching TV will still exhibit hyperactive behavior or inattention (Page et al., 2010). It can be seen that children's use of electronic media has a far greater impact on attention than imagined. Even if parents try to prevent it, children will still have inattentive behavior due to the long term use of electronic media.

Furthermore, the factors of parenting also affect children's attention since they use electronic media. According to Su Yingting (2015), the children will use different types of electronic media in their daily life. And the reasons why parents allow children to use electronic media and the ways to allow children to use electronic media are also the main points that will affect their attention. For example, parents or caregivers will let children use electronic media since they do not have time to accompany their children and use it while eating. So, these are the factors that parents will use to affect children's attention. If children cannot use electronic media in their life properly, such as use it while eating, the symptoms of attention deficit and hyperactivity will become more obvious. Also, the research results of the scholars from different countries on children's use of electronic media are consistent. So that if children use electronic media in a poor way and use it for a long time, such as primary school students, they should not use electronic media for more than two hours per day (Center for Health Protection, 2019). Otherwise, their attention performance will be worse.

2.2 Research on using electronic media and language development

Positive impact

First, children's use of electronic media can improve their language skills.

Madigan mentioned that if children want to improve their language skills through electronic media, the age of they start to use electronic media is one of the key points. Children who begin using electronic media at an older age have greater benefits in improving language skills than children who begin using electronic media at an early age (before children learn to speak their first words.) (Madigan, 2020). Moreover, Chonchaiya and Pruksananonda (2008) interviewed parents of children with language delays in Thailand. They found that children with language delays often start watching TV before they can speak their first words, while those with normal language development usually start watching TV after they can speak words. Also, children who start watching TV when they are younger than one year old and watch TV for more than 2 hours. The language delays will be more likely than in other children six times. In other words, that means if children start using electronic media too early, their language development will be affected.

In addition, children's language development is also affected by their educational or non-educational program and interactions with their parents when they use electronic media. According to the Alberta Children's Hospital Research Institute in Canada, the University of Calgary, and the University of Washington-Seattle Children's Hospital in the USA, they pointed out that the purpose and method of children's use of electronic media are also the keys to improving language ability. For example, children using electronic media for educational, and interactive purposes with their parents can have a positive impact on the development of their language skills (Madigan, 2020).

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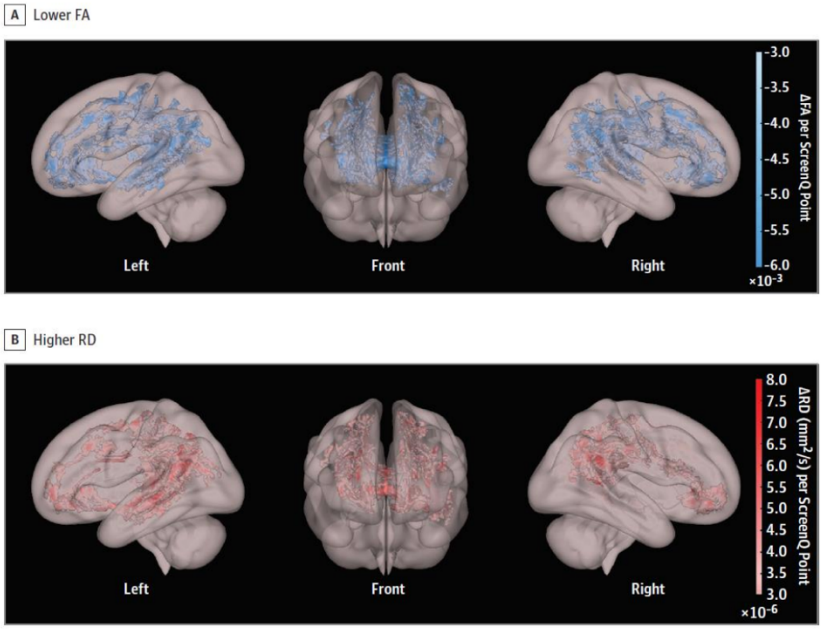
Since the scholar Liu Youjia by Taiwanese research found that if children aged two to three watched non-educational programs for a long time, their scores on how to use language and language expression were lower, their language skills may fall behind those of other children (Liu Youjia, 2010). It can be seen that if children want to improve their language skills through electronic media, parents need to control the propose of electronic media which can be educational programs, and try to interact with them, so that children can use electronic media more correctly and improve their language skills.

Negative impact

First, according to the Alberta Children's Hospital Research Institute in Canada, the University of Calgary,and the University of Washingt on-Seattle in the USA, children's use of electronic media for a long time will lead to poor performance in their language skills (Madigan, 2020). It can be seen that watching too much television can have potential adverse effects due to insufficient verbal expression.

Therefore, long-term use of electronic media can lead children to poor vocabulary expression and phonological processing (Martinot). This occurs when children aged 2 to 4 years old have more than 4 hours of screen time per day [Takahashi]. This is also evidenced by the changes in the white matter of the brain during early development, particularly in areas responsible for language processing, such as the arcuate fasciculus, which supports single-word semantic processing.

Figure 6



White matter voxels exhibit a statistically significant correlation between screen-based media use (ScreenQ scores) and lower fractional anisotropy (FA; A) as well as higher radial diffusivity (RD; B) in whole-brain analysis, controlling for child age and household income level ($P < .05$, familywise error–corrected). Color indicates the slope or magnitude of correlation (ie, change in the DTI parameter for every point increase in ScreenQ score).

So, in terms of a medical perspective, according to a study by Cincinnati Children's Hospital Medical Center in Ohio (2019), 69 children aged 3-5 years old underwent brain Magnetic Resonance Imaging (MRI) and Diffusion Tensor Imaging (DTI) to find out the relationship between young children's use of electronic media and indicators of "White Matter Integrity" in the brain. And the study specifically assessed language expression, executive function and literacy development as relevant factors in assessing cognitive behavior. The findings show that young children's use of electronic media can be detrimental and harmful to language development. If children spend more time using electronic media, the integrity of their brain's white matter becomes worse (Hutton, 2020). Also, since the main function of the brain's white matter is to control signals shared by neurons and coordinate the normal operation between brain regions. Therefore, if the brain's white matter is incomplete, it will affect the brain's connections with the language ability.

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Relationship between use of electronic media and language development

Table 7 Research of Zhang Jianru (2021)

幼兒電子產品使用時間與其發展之相關分析

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
（1）電視時間	--	.181**	-.043*	-.130**	-.138**	-.023	-.107**	-.062**	-.063**	-.063**	-.022	-.129**
（2）其他電子產品時間			-.043*	-.136**	-.130**	-.023	-.095**	-.015	-.057**	-.029	-.039	-.100**
（3）語言理解				.570**	.454**	.424**	.454**	.296**	.452**	.451**	.327**	.403**
（4）語言表達					.554**	.480**	.534**	.425**	.599**	.548**	.383**	.538**
（5）讀寫萌發						.445**	.554**	.318**	.455**	.468**	.379**	.480**
（6）粗大動作							.642**	.301**	.430**	.464**	.356**	.401**
（7）精細動作								.295**	.433**	.471**	.372**	.459**
（8）情緒覺察									.488**	.514**	.348**	.442**
（9）情緒表達										.618**	.416**	.440**
（10）情緒理解											.490**	.480**
（11）情緒調節												.456**
（12）注意力／執行功能												--

*$p < .05$. **$p < .01$.

The above analysis results of Zhang Jianru (2021) show that the relationship between children spent time on watching TV and language ability. In terms of language ability, there was a small negative correlation in language understanding ($r = -.043$, $P < 0.05$) and language expression ($r = -.130$, $P < 0.01$) between time spent watching TV and language.

Also, Madigan considers a relationship in a systematic review and meta-analysis. They examined non-experimental associations between time spent on electronic media and language skills in children aged 12 years or younger. (Madigan, 2020). They reported whether time spent using electronic media included watching TV, computers, mobile phones, and game consoles. There was a small negative correlation ($r = -.14$) between time spent using electronic media and language skills. However, language skills were positively and weakly

correlated with exposure to educational content (r = .13) and time spent watching video content with parents or caregivers (r = .16). For samples with the above characteristics, the latter has a stronger correlation with co viewing.

2.3 Research on using electronic media in learning ability and memory development

Negative impact

First, scholars Lui and Wong pointed out that children's use of electronic media will affect their concentration, memory and learning abilities. Based on previous research, it has been pointed out that long-term use of electronic media will lead to the problem of insufficient concentration and the inability to concentrate for a long time when learning, thereby failing to memorize effectively and apply knowledge, leading to a decline in learning ability and academic performance. Furthermore, children who use smartphones frequently have shorter attention spans than children who do not use smartphones frequently (Lui and Wong, 2012). Therefore, children who use smartphones frequently would fail to implement the complete learning process effectively. For example, children only focus on class for ten minutes before being distracted, resulting in ineffective memory and the learning of new knowledge, leading to a decline in academic performance.

Moreover, Hysing pointed out that electronic media is related to sleep pattern disorders, which can also affect learning. Adolescents who use electronic media before bedtime, may have increased sleep problems and daytime sleepiness, which may impair cognitive function and academic performance (Hysing, 2015). Over the past 20 years, scientists have discovered that sleep not only affects a student's ability to perform. Since sleep can contribute to their ability to learn, remember, retain, recall, and use new knowledge to solve problems creatively (Kelly cappello, 2020). However, if children use electronic media before bedtime, it will increase the problem

of poor sleep quality, which will affect students' performance in class, such as poor memory and low learning motivation, thus affecting academic performance.

2.4 Research on using electronic media and executive abilities

Negative impact

Children's use of electronic media can lead to executive function problems.

First, in November 2020, the University of Hong Kong with research teams from the Polytechnic University, City University, Shanghai Jiao Tong University, and funded by the Hong Kong Jockey Club Charities Trust, published a report on electronic media used by families and young children. The research team pointed out that children from families with lower socioeconomic status may have parents who are busy with work and they do not have time to spend with them. As a result, children from these families are more likely to experience excessive use of electronic media. Since there is a lack of quality interaction between them and their parents, some behavioral problems will occur.

In addition, parents who use electronic media frequently may spend less time on "non-screen" family activities, such as outings and interactive. Also, they will not use electronic media with children to make an interactive with them. So that children will accept different information whether it is good or not easily. And prolonged use may reduce a parent's ability to respond and to pay attention to their children (Rosa, 2020). Thereby, it will make children susceptible to accepting wrong information, affect children's executive abilities, and cause them to have behavioral problems.

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Section3: Relationship between on use time of electronic media and executive ability

Table7 Research of Zhang Jianru (2021)

幼兒電子產品使用時間與其發展之相關分析

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（12）注意力／執行功能												--

*$p < .05$. **$p < .01$.

The above analysis results of Zhang Jianru (2021) show that the relationship between children spent time on watching TV and execution ability. In terms of execution ability, there was a small negative correlation ($r = -.129$, $P < 0.01$) between time spent watching TV and execution ability and the attention.

Moreover, the significant average causal mediation effect (ACME) of electronic media use time on executive ability-mediated behavioral problems was $\beta = 0.28$, 95% CI [0.13-0.44]. Accounting for more than half of the total effect (54.9%, 95% CI [37.4- 100%]). The current study suggests that increases in behavioral problems among preschoolers may be due in part to the direct effects of prolonged electronic media use and the mediating effects of impaired executive ability. (Narueporn, 2024)

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Chapter 3: Methodology

This chapter is about research methods and can be divided into four sections. The first section describes the research method and design, the second section describes the research participants and sampling methods, the third section describes the data collection and analysis tool and the fourth section describes research procedures and ethical considerations.

Section 1: Research method and design

This study conducted a questionnaire to collect the data. Based on the research motivation, research purpose, research questions and literature review, there will be discussion in related fields.

For the questionnaire questions, they were formulated in a structure that uses "Personal Background Variables" as independent variables, and then "Children's habits and patterns of using electronic media" and "Areas of influence on cognitive development" as dependent variables.

Independent variables

Personal background variables, including gender, age, children's education level and parent's education level.

Table 8

Background information of children and family

Item	Group	Frequency	Percent (%)
Gender	Female	28	53.8
	Male	24	46.2
Age	1-5 years old	34	65.4
	6-10 years old	10	19.2
	11-15 years old	3	5.8
	16-17 years old	5	9.6
Education level	Pre-schooler	13	25
(Children)	Kindergarten	21	40.4
	Primary school	10	19.2
	Secondary school	8	15.4
Education level	Primary school	0	0
(Parent)	Secondary school	23	44.2
	University / College	25	48.1
	Professional / Other	4	7.7

Dependent variables

Children's habits and patterns of using electronic media, including age of first exposure electronic media, most commonly used electronic media, purpose of use, time of use, and usage habits (using while eating, before bedtime, and parental accompanied by parents)

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Cognitive development areas, including learning ability, language ability, attention, memory and executive ability

Section 2: Participants and sampling methods

Participants

A total of 52 children and parents (N=male: 24; female: 28) was invited to complete the quationaire about the impact of electronic media on the children's cognitive development in Hong Kong.

In addition, based on the University of Bristol in the UK, which surveyed 1,013 children with an average age of 10 years old on their use of electronic media on the development of concentration, it designed a questionnaire to be filled out by parents (Page et al., 2010). In this regard, I also invited parents who have a child under the age of 18 (United Nations,1989) to complete the questionnaire and filled out by them. As the reference by the University of Bristol , the questionnaire fill out by parents who was the caregiver of children can be more understand and behalf the children, so that it will be more accurate of their habits in daily life, also improve the reliability and validity, so that I used the same method to invite parents to complete the questionnaire. And they had to scan the QR Code for online questionnaire during the process of data collection.

Sampling method

This study used purposive sampling and snowball sampling. In the process of data collect, I visited a park near the kindergarten and primary school around after school time (2pm to 6pm) in the two days. The reason why I choose that it is because it can help me to select the targets more easily and quickly, I was able to find

different parents who have a child under the age of 18 to fill out the questionnaires. Also, I could invite their friends next to the parents to complete the questionnaires at the same time so that I can complete the data collection successfully.

Then, all participants in this study had received a consent form and information sheet (for parents) before they took part in the research to further confirm their permission and signed on it for the approval of conducting the research.

Section 3: Data collection and analysis tool

The questionnaires with 18 questions in total were distributed to assess the impact of electronic media on the children's cognitive development in Hong Kong: Part 1 Demographic Characteristics, which contains 4 questions collecting children and parents demographic information, including gender, age and education level; Part 2 The habits and patterns that the children use of electronic media , which consists of 7 questions related to their electronic media using habits and mode in their daily life. Part 3 The scope of the impact of cognitive development using electronic media, which consists of 7 questions related to attention, language, learning, memory and execution ability. Parents were required to respond to each statement with the 5-point Likert Scale (SA: Strongly Agree; A: Agree; N: Neutral; D: Disagree; SD: Strongly Disagree)

Analysis tool

Statistical Program for Social Sciences (SPSS) 29.0—Frequency and Correlation was used for quantitative data analysis to analyze the relationships between the electronic media using and cognitive development of the children.

Section 4: Research Procedures and ethical considerations

After the ethical review application was submitted for approval at the end of November, the research started during my second block practice. Then, the consent form and information sheet were signed and read by parents and children who were under 18 before filling out the questionnaire. And it was conducted anonymously. After that, the identifying information will be removed from the data file and stored separately and the data will be kept secretly and will destroy after 1 year to protect the privacy of participants.

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Chapter 4: Data analysis

Section1: Frequency analysis

Table 9 Frequencies of the situation in habit and pattern of children use the electronic media in Hong Kong

The situation of Children's Use of Electronic Media

Item	Group	Frequency	Percent (%)
How old were you when you exposed electronic media for the first time?	1-5 years old	48	92.3
	6–10 years old	4	7.7
	11-15 years old	0	0
	16-17 years old	0	0
What electronic media do you use the most?	Mobile phone	21	40.4
	Computer	1	1.9
	IPad	21	40.4
	TV	8	15.4
	Console	1	1.9
What is your primary use of electronic media?	Watch TV/Movie/Video	27	51.9
	Study	11	21.2
	Play game	14	26.9
	FaceTime/social	0	0
How much time do you spend using electronic media on an average day?	Within 1 hour	7	13.5
	1-4 hours	37	71.2
	5-8 hours	8	15.4
	9-11 hours	0	0
	12 hours or above	0	0
Do you use electronic media while eating?	Yes	33	63.5
	No	19	36.5
Do you use electronic media before going to bed?	Yes	30	57.7
	No	22	42.3
When you use electronic media, do your parents watch or discuss the content with you?	Yes	16	30.8
	No	26	69.2

The above table shows that the situation in habit and pattern of children use the electronic media in Hong Kong. The total number of respondents and percentages are shown in each categorized element.

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Habits

A total number of 52 valid questionnaires were collected successfully. The collection rate was 100% (N=52). It is clearly presented that the majority of the children exposed electronic media for the first time when they were 1-5years old (N=48) with 92.3%. Then most children used Mobile phone and iPad (N=21)with 40.4 % for each. Most of them used it to watch TV, movie and video (N=27) with 51.9%. And also they used 1-4hours on an average day (N=27) with 71.2%.

Using Pattern

Children using electronic media while eating (N=33) with 63.5%, and most of them also used it before bedtime (N=30) with 57.7%. Then, when they were using electronic media , most of parents will not to discuss and content with children (N=26) with 69.2%.

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Table 10

Frequencies of the impact of cognitive development on children use the electronic media in Hong Kong

The situation on Impact of cognitive development

Item	Group	Frequency	Percent (%)
In your daily life, do you agree that your ability to learn new things has increased?	Strongly agree	3	5.8
	Agree	30	57.7
	Neutral	18	34.6
	Disagree	1	1.9
	Strongly disagree	0	0
Do you understand and apply new vocabulary and concepts learned from electronic media?	Strongly agree	2	3.8
	Agree	39	75
	Neutral	9	17.3
	Disagree	2	3.8
	Strongly disagree	0	0
Do you express your needs and feelings to others clearly?	Strongly agree	0	0
	Agree	22	42.3
	Neutral	29	55.8
	Disagree	1	1.9
	Strongly disagree	0	0
When you study, do you stay focused until things are done?	Strongly agree	1	1.9
	Agree	16	30.8
	Neutral	20	38.5
	Disagree	15	28.8
	Strongly disagree	0	0
At school, do you comply with the teacher's requirements?	Strongly agree	0	0
	Agree	27	51.9
	Neutral	22	42.3
	Disagree	3	5.8
	Strongly disagree	0	0
Do you think your memory is good?	Strongly agree	0	0
	Agree	23	44.2
	Neutral	28	53.8
	Disagree	1	1.9
	Strongly disagree	0	0
Do you think your academic performance is good?	Strongly agree	0	0
	Agree	22	42.3
	Neutral	26	50
	Disagree	4	7.7
	Strongly disagree	0	0

Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

The above table shows that the impact of cognitive development on children use the electronic media in Hong Kong.

From the data above, it can be concluded that the use of electronic media by Hong Kong children will have an impact on their cognitive development. Compared with the agreed options, learning ability of vocabulary is most affected by electronic media on Hong Kong children. (N=39) with 75%. Then, second ranking still the learning ability of new knowledge (N=30) with 57.7%. The third ranking is execution ability (N=27) with 51.9%. So that we can found out that the learning and execution ability is the most affected by Hong Kong children when they are using electronic media.

Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

Section2: Correlation analysis

Table11

Correlation between children's age of using electronic media and cognitive development in Hong Kong

Correlations

		Age	Learning (Knowledge)	Learning (Academic Performance)	Language (Vocabulary)	Language (Expression)	Attention	Execution ability	Memory
Age	Pearson Correlation	1	.549**	.379**	.191	.020	.092	-.122	.491**
	Sig. (2-tailed)		<.001	.006	.174	.891	.516	.389	<.001
	N	52	52	52	52	52	52	52	52
Learning (Knowledge)	Pearson Correlation	.549**	1	.504**	.522**	.290*	.422**	.148	.603**
	Sig. (2-tailed)	<.001		<.001	<.001	.037	.002	.294	<.001
	N	52	52	52	52	52	52	52	52
Learning (Academic Performance)	Pearson Correlation	.379**	.504**	1	.540**	.515**	.608**	.656**	.844**
	Sig. (2-tailed)	.006	<.001		<.001	<.001	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52
Language (Vocabulary)	Pearson Correlation	.191	.522**	.540**	1	.414**	.524**	.567**	.489**
	Sig. (2-tailed)	.174	<.001	<.001		.002	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52
Language (Expression)	Pearson Correlation	.020	.290*	.515**	.414**	1	.658**	.501**	.419**
	Sig. (2-tailed)	.891	.037	<.001	.002		<.001	<.001	.002
	N	52	52	52	52	52	52	52	52
Attention	Pearson Correlation	.092	.422**	.608**	.524**	.658**	1	.530**	.563**
	Sig. (2-tailed)	.516	.002	<.001	<.001	<.001		<.001	<.001
	N	52	52	52	52	52	52	52	52
Execution ability	Pearson Correlation	-.122	.148	.656**	.567**	.501**	.530**	1	.531**
	Sig. (2-tailed)	.389	.294	<.001	<.001	<.001	<.001		<.001
	N	52	52	52	52	52	52	52	52
Memory	Pearson Correlation	.491**	.603**	.844**	.489**	.419**	.563**	.531**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	.002	<.001	<.001	
	N	52	52	52	52	52	52	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The above analysis results show that the relationship between children's age of using electronic media and cognitive development in Hong Kong. First, in terms of learning ability, there were a positively correlation between children's age of using electronic media and learning new knowledge $r = .549$ ($p < 0.01$) and academic performance $r = .379$ ($p < 0.01$) respectively. Then, in terms of language ability, attention and execution ability, there were no correlation between children's age of using electronic media and language ability, attention and execution ability. Finally, in terms of memory, there is positively correlation $r = .491$ ($p < 0.01$) between children's age of using electronic media and memory in Hong Kong. It can be found that Hong Kong children's use of electronic media from an early age or older age also have correlation to the cognitive of development on

their learning abilities and memory.

Table 12

Correlation between children spent time on electronic media and cognitive development in Hong Kong

Correlations

		Average time spent using electronic media per day	Learning (Knowledge)	Learning (Academic Performance)	Language (Vocabulary)	Language (Expression)	Attention	Execution ability	Memory
Average time spent using electronic media per day	Pearson Correlation	1	.567**	.369**	.303*	.231	.265	.027	.433**
	Sig. (2-tailed)		<.001	.007	.029	.100	.057	.847	.001
	N	52	52	52	52	52	52	52	52
Learning (Knowledge)	Pearson Correlation	.567**	1	.504**	.522**	.290*	.422**	.148	.603**
	Sig. (2-tailed)	<.001		<.001	<.001	.037	.002	.294	<.001
	N	52	52	52	52	52	52	52	52
Learning (Academic Performance)	Pearson Correlation	.369**	.504**	1	.540**	.515**	.608**	.656**	.844**
	Sig. (2-tailed)	.007	<.001		<.001	<.001	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52
Language (Vocabulary)	Pearson Correlation	.303*	.522**	.540**	1	.414**	.524**	.567**	.489**
	Sig. (2-tailed)	.029	<.001	<.001		.002	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52
Language (Expression)	Pearson Correlation	.231	.290*	.515**	.414**	1	.658**	.501**	.419**
	Sig. (2-tailed)	.100	.037	<.001	.002		<.001	<.001	.002
	N	52	52	52	52	52	52	52	52
Attention	Pearson Correlation	.265	.422**	.608**	.524**	.658**	1	.530**	.563**
	Sig. (2-tailed)	.057	.002	<.001	<.001	<.001		<.001	<.001
	N	52	52	52	52	52	52	52	52
Execution ability	Pearson Correlation	.027	.148	.656**	.567**	.501**	.530**	1	.531**
	Sig. (2-tailed)	.847	.294	<.001	<.001	<.001	<.001		<.001
	N	52	52	52	52	52	52	52	52
Memory	Pearson Correlation	.433**	.603**	.844**	.489**	.419**	.563**	.531**	1
	Sig. (2-tailed)	.001	<.001	<.001	<.001	.002	<.001	<.001	
	N	52	52	52	52	52	52	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The above analysis results show that the relationship between children spent time on electronic media and cognitive development in Hong Kong. First, in terms of learning ability, the positively correlation $r = .567$ ($p < 0.01$) and $r = .369$ ($p < 0.01$) between children spent time on electronic media and learning ability in Hong Kong respectively. Then, in terms of language ability, the positively correlation $r = .303$ ($p < 0.05$) between children spent time on electronic media and vocabulary language skill. In contrast, in terms of language expressive ability, there was no correlation between that. Furthermore, in terms of attention and execution ability, there were also no correlation between children spent time on electronic media. Finally, in terms of

memory, the positively correlation r = .433 ($p < 0.01$) between children spent time on electronic media and memory. It can be found that the even children spent less or more time on electronic media, it will affect their cognitive development of learning, language and memory.

Table 13

Correlation between children's family factors of using electronic media and cognitive development in Hong Kong

Correlations

		Using electronic media while eating	Using electronic media before sleep	Using electronic media with parent	Learning (Knowledge)	Learning (Academic Performance)	Language (Vocabulary)	Language (Expression)	Attention	Execution ability	Memory
Using electronic media while eating	Pearson Correlation	1	.159	-.273	-.275*	-.222	-.142	-.251	-.142	-.081	-.223
	Sig. (2-tailed)		.262	.050	.048	.114	.314	.072	.316	.566	.113
	N	52	52	52	52	52	52	52	52	52	52
Using electronic media before sleep	Pearson Correlation	.159	1	-.441**	-.458**	-.529**	-.320*	-.377**	-.415**	-.119	-.490**
	Sig. (2-tailed)	.262		.001	<.001	<.001	.021	.006	.002	.400	<.001
	N	52	52	52	52	52	52	52	52	52	52
Using electronic media with parent	Pearson Correlation	-.273	-.441**	1	.425**	.504**	.396**	.358**	.462**	.388**	.645**
	Sig. (2-tailed)	.050	.001		.002	<.001	.004	.009	<.001	.004	<.001
	N	52	52	52	52	52	52	52	52	52	52
Learning (Knowledge)	Pearson Correlation	-.275*	-.458**	.425**	1	.504**	.522**	.290*	.422**	.148	.603**
	Sig. (2-tailed)	.048	<.001	.002		<.001	<.001	.037	.002	.294	<.001
	N	52	52	52	52	52	52	52	52	52	52
Learning (Academic Performance)	Pearson Correlation	-.222	-.529**	.504**	.504**	1	.540**	.515**	.608**	.656**	.844**
	Sig. (2-tailed)	.114	<.001	<.001	<.001		<.001	<.001	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52	52	52
Language (Vocabulary)	Pearson Correlation	-.142	-.320*	.396**	.522**	.540**	1	.414**	.524**	.567**	.489**
	Sig. (2-tailed)	.314	.021	.004	<.001	<.001		.002	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52	52	52
Language (Expression)	Pearson Correlation	-.251	-.377**	.358**	.290*	.515**	.414**	1	.658**	.501**	.419**
	Sig. (2-tailed)	.072	.006	.009	.037	<.001	.002		<.001	<.001	.002
	N	52	52	52	52	52	52	52	52	52	52
Attention	Pearson Correlation	-.142	-.415**	.462**	.422**	.608**	.524**	.658**	1	.530**	.563**
	Sig. (2-tailed)	.316	.002	<.001	.002	<.001	<.001	<.001		<.001	<.001
	N	52	52	52	52	52	52	52	52	52	52
Execution ability	Pearson Correlation	-.081	-.119	.388**	.148	.656**	.567**	.501**	.530**	1	.531**
	Sig. (2-tailed)	.566	.400	.004	.294	<.001	<.001	<.001	<.001		<.001
	N	52	52	52	52	52	52	52	52	52	52
Memory	Pearson Correlation	-.223	-.490**	.645**	.603**	.844**	.489**	.419**	.563**	.531**	1
	Sig. (2-tailed)	.113	<.001	<.001	<.001	<.001	<.001	.002	<.001	<.001	
	N	52	52	52	52	52	52	52	52	52	52

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The above analysis results show that the relationship between children's family factors of using electronic media and cognitive development in Hong Kong.

First, in terms of children using electronic media while eating, there was a small negative correlation r =

-.275 ($p < 0.05$) between using electronic media while eating and learning skills in knowledge. However, the language, attention, execution and memory ability have no correlation between the children using electronic media while eating.

Moreover, in terms of children using electronic media before sleep, there was a negative correlation between learning in knowledge $r = -.458$ ($p < 0.01$) , learning in academic performance $r = -.529$ ($p < 0.01$) , language in vocabulary $r = -.320$ ($p < 0.05$) , language in expression $r = -.377$ ($p < 0.01$), attention $r = -.415$ ($p < 0.01$) and memory $r = -.490$ ($p < 0.01$)between children using electronic media before sleep. And the execution ability was no correlation between children using electronic media before sleep.

Furthermore, in terms of children using electronic media with parents, there were positively correlation between all the cognitive development. First, in learning knowledge and academic performance, there were $r = .425$ ($p < 0.01$) and $r = .504$ ($p < 0.01$) respectively. Then, in terms of language ability, language of new vocabulary and language expression development were $r = .396$ ($p < 0.01$) and $r = .358$ ($p < 0.01$) respectively. Then, for the attention, execution ability, and memory were $r = .462$ ($p < 0.01$), $r = .388$ ($p < 0.01$), and $r = .645$ ($p < 0.01$). It can be found that Hong Kong children's use of electronic media with parents or not can affect their all the area of cognitive development.

Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

Chapter 5: Discussion

Section1: Finding

5.1 Compare the result of the impact of cognitive development on children use the electronic media

The situation on Impact of cognitive development

Item	Group	Frequency	Percent (%)
In your daily life, do you agree that your ability to learn new things has increased?	Strongly agree	3	5.8
	Agree	30	57.7
	Neutral	18	34.6
	Disagree	1	1.9
	Strongly disagree	0	0
Do you understand and apply new vocabulary and concepts learned from electronic media?	Strongly agree	2	3.8
	Agree	39	75
	Neutral	9	17.3
	Disagree	2	3.8
	Strongly disagree	0	0
Do you express your needs and feelings to others clearly?	Strongly agree	0	0
	Agree	22	42.3
	Neutral	29	55.8
	Disagree	1	1.9
	Strongly disagree	0	0
When you study, do you stay focused until things are done?	Strongly agree	1	1.9
	Agree	16	30.8
	Neutral	20	38.5
	Disagree	15	28.8
	Strongly disagree	0	0
At school, do you comply with the teacher's requirements?	Strongly agree	0	0
	Agree	27	51.9
	Neutral	22	42.3
	Disagree	3	5.8
	Strongly disagree	0	0
Do you think your memory is good?	Strongly agree	0	0
	Agree	23	44.2
	Neutral	28	53.8
	Disagree	1	1.9
	Strongly disagree	0	0
Do you think your academic performance is good?	Strongly agree	0	0
	Agree	22	42.3
	Neutral	26	50
	Disagree	4	7.7
	Strongly disagree	0	0

Lui and Wong mentioned that children's use of electronic media will lead to reduced attention, poor memory and poor learning ability. Children who use smartphones frequently have shorter attention spans than children who do not use smartphones frequently (Lui and Wong, 2012). Therefore, children who use electronic media

will have shorter attention spans than children who do not use electronic media frequently and cause poor academic performance.

However, I disagree the point of the scholar. In this research shows that, there were (N=39) 75% and (N=30)57.7% of children use electronic media can help their learning and improve the academic performance which is the higher ranking. In addition, with the technology improve and innovation of the generation, there are lots of E-learning applications for parents and children to use, such as mathematics. Children can complete mathematics questions or supplementary courses at home by using mobile phones or computers. In addition, most of the children surveyed are children aged 1-5 years old. That means they had a ZOOM class during Covid19 in kindergarten. It can be found that they should have adapted to using electronic media for learning already. Therefore, for the new generation of Hong Kong children, electronic media must be an important tool to the children for helping their learning.

Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

5.2 Compare with the result on the relationship between using time of electronic media and language and execution ability

Research of Zhang Jianru (2021)

幼兒電子產品使用時間與其發展之相關分析

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
（1）電視時間	--	.181**	-.043*	-.130**	-.138**	-.023	-.107**	-.062**	-.063**	-.063**	-.022	-.129**
（2）其他電子產品時間			-.043*	-.136**	-.130**	-.023	-.095**	-.015	-.057**	-.029	-.039	-.100**
（3）語言理解				.570**	.454**	.424**	.454**	.296**	.452**	.451**	.327**	.403**
（4）語言表達					.554**	.480**	.534**	.425**	.599**	.548**	.383**	.538**
（5）讀寫萌發						.445**	.554**	.318**	.455**	.468**	.379**	.480**
（6）粗大動作							.642**	.301**	.430**	.464**	.356**	.401**
（7）精細動作								.295**	.433**	.471**	.372**	.459**
（8）情緒覺察									.488**	.514**	.348**	.442**
（9）情緒表達										.618**	.416**	.440**
（10）情緒理解											.490**	.480**
（11）情緒調節												.456**
（12）注意力／執行功能												--

*$p < .05$. **$p < .01$.

Table 14 Correlation between time spent on electronic media and cognitive development

Correlations

		Average time spent using electronic media per day	Learning (Knowledge)	Learning (Academic Performance)	Language (Vocabulary)	Language (Expression)	Attention	Execution ability	Memory
Average time spent using electronic media per day	Pearson Correlation	1	.567**	.369**	.303*	.231	.265	.027	.433**
	Sig. (2-tailed)		<.001	.007	.029	.100	.057	.847	.001
	N	52	52	52	52	52	52	52	52
Learning (Knowledge)	Pearson Correlation	.567**	1	.504**	.522**	.290*	.422**	.148	.603**
	Sig. (2-tailed)	<.001		<.001	<.001	.037	.002	.294	<.001
	N	52	52	52	52	52	52	52	52
Learning (Academic Performance)	Pearson Correlation	.369**	.504**	1	.540**	.515**	.608**	.656**	.844**
	Sig. (2-tailed)	.007	<.001		<.001	<.001	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52
Language (Vocabulary)	Pearson Correlation	.303*	.522**	.540**	1	.414**	.524**	.567**	.489**
	Sig. (2-tailed)	.029	<.001	<.001		.002	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52
Language (Expression)	Pearson Correlation	.231	.290*	.515**	.414**	1	.658**	.501**	.419**
	Sig. (2-tailed)	.100	.037	<.001	.002		<.001	<.001	.002
	N	52	52	52	52	52	52	52	52
Attention	Pearson Correlation	.265	.422**	.608**	.524**	.658**	1	.530**	.563**
	Sig. (2-tailed)	.057	.002	<.001	<.001	<.001		<.001	<.001
	N	52	52	52	52	52	52	52	52
Execution ability	Pearson Correlation	.027	.148	.656**	.567**	.501**	.530**	1	.531**
	Sig. (2-tailed)	.847	.294	<.001	<.001	<.001	<.001		<.001
	N	52	52	52	52	52	52	52	52
Memory	Pearson Correlation	.433**	.603**	.844**	.489**	.419**	.563**	.531**	1
	Sig. (2-tailed)	.001	<.001	<.001	<.001	.002	<.001	<.001	
	N	52	52	52	52	52	52	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The above analysis results show that children time spent on using electronic media and cognitive development

Compare with language development

The two tables above, Zhang Jianru (2021) pointed out that small negative correlation between using time of electronic media (TV) and language understanding r = -.043 ($p < 0.05$) and language expression r = -.130 ($p < 0.01$) . However, for my research found that, the correlation between the time of children's using electronic media and language in vocabulary(understand), there was positive correlation r = 303 ($p < 0.05$) and no correlation in language expression. It can be found that children's use of electronic media still has some positive correlation with their language development. Also, if aged 2-4 years old children use electronic media over 4

hours per day, they may lead to poor vocabulary and expression (Martinot). Also, their white matter also will affect in their brain particularly the areas responsible for language processing.

Compare with executive ability

Then, Zhang Jianru (2021) also pointed out that there was also small negative correlation between watching TV time and the ability of executive ability which was $r = -.129$ ($p < 0.01$). And I also found that in this research the correlation between the time of children's using electronic media and execution ability was no correlation. So that we can see that there was no relationship between using time of electronic media and execution ability.

Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

5.3 Table 15 Compare the result for the correlation of the language development between the time spend on using electronic media and family factors

Correlations

		Language (Vocabulary)	Language (Expression)	Average time spent using electronic media per day	Using electronic media with parent
Language (Vocabulary)	Pearson Correlation	1	.414**	.303*	.396**
	Sig. (2-tailed)		.002	.029	.004
	N	52	52	52	52
Language (Expression)	Pearson Correlation	.414**	1	.231	.358**
	Sig. (2-tailed)	.002		.100	.009
	N	52	52	52	52
Average time spent using electronic media per day	Pearson Correlation	.303*	.231	1	.334*
	Sig. (2-tailed)	.029	.100		.015
	N	52	52	52	52
Using electronic media with parent	Pearson Correlation	.396**	.358**	.334*	1
	Sig. (2-tailed)	.004	.009	.015	
	N	52	52	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Firstly, Madigan considers a relationship between time spent on electronic media and language skills in children aged 12 years or below. (Madigan, 2020). The reported whether time spent using electronic media included watching TV, computers, mobile phones, and game consoles. There was a small negative correlation ($r = -.14$) between time spent using electronic media and language skills. However, in this research, I found that there was a positive correlation ($r = 303$, $P < 0.05$) between time spent using electronic media and language skills in vocabulary. So that it may still have a relationship between the time spend using electronic media and language development.

In addition, in terms of family factor, Madigan also found that language skills were positively correlated with parents use electronic media with children ($r = .16$). Also in this research, I found that there was also positive

correlation between language skills and the parents using electronic media with children, there was ($r = 396$, $P < 0.01$) in language of vocabulary and ($r = 358$, $P < 0.01$) in language of expression. So that it may found that if parent spent time to use electronic media with children or not, it may be affect the language development of children. Since the children using electronic media for educational, and interactive purposes with their parents can have a positive impact on the development of their language skills (Madigan, 2020).

Section2: Future Implications

In this research, I found out that the electronic media had a biggest impact in children's learning area of their cognitive development. Also, the children using electronic media will be more rejuvenation in the future trend that point out it will have a power impact on their cognitive development in Hong Kong. Also, Su Yingting (2015) mentioned that since the technology advance, electronic media will become more popular in the future, it will provide lots of learning opportunities, information and resources let the children gain the knowledge, to broadening their horizons and cognitive scope. Furthermore, with the development of educational technology and artificial intelligence, the E-book may be the future trend at the education area.

However, Su Yingting (2015) also mentioned that if children use electronic media without parents, it will have a negative impact on children's growth. Also, in this study, I found out that the relationship between children using electronic media with parent and cognitive development, there were all positive correlation between both. In addition, I also found that if children use the electronic media to have some educational program, it may be a big help for their learning.

In future , to improve the children learning and academic performance, parents may change their habits in dealing with children's use of electronic media , such as to accompany their children when they using electronic media to assist to their learning and language development and also watch some educational program with them. For government , it can be consider to use a E-Book in the future for the education to better assist children in learning .

Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

Chapter 6: Research Gap

In the past , with the rapid of technology development , electronic media has played an important role in children's daily lives. However, there are still some important research gaps regarding the impact of electronic media on the cognitive development of Hong Kong children.

First, in terms of literature of knowledge gap. Although the past of literature studies have explored the impact of electronic media on children's cognitive development, most of them have focused on children in foreign countries. For Hong Kong children, the cultural background, education system and environment may be different from those of children in other countries. Therefore, I hope it will be necessary to conduct research on Hong Kong children in the future to gain an in-depth and comprehensive understanding of the impact of electronic media on the cognitive development to understand the media usage of the new generation of Hong Kong children.

In addition, most of current research on the impact of electronic media on cognitive development mainly focuses on the negative impact. Therefore, this study Knowledge gaps and reservations remain regarding the positive effects of electronic media on children's cognitive development.

As technology advances, it is hoped that be more comprehensive research will be conducted on the benefits of electronic media on cognitive development in the future, and more practical advice and assistance will be provided to caregivers and educators of children.

In summary, the impact of electronic media on the cognitive development of Hong Kong children is an important topic worthy of further study. I think future research should focus on the specific background of Hong Kong children and select groups for research, or conduct more targedet and details research on only the electronic media range of mobile phones. It also studies the positive and negative impacts of mobile phones and proposes effective ways to use them to promote the cognitive development of Hong Kong children and adapt to the learning environment in the technological age.

Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

Chapter7: Limitation

In this research, I only studied and mentioned some of the opinions of these topic. There are still have a big potential to explore more of the impact of electronic media on the cognitive development of Hong Kong children. However, these research materials can provide a basic framework and reference for future researchers. For example: conduct more detail research area and analysis on the mobile phones area or iPad of electronic media used most by children in Hong Kong today.

Furthermore, due to lack of resources, the research time was limited and also I did not have a assistant in the process of data collection. So that I just collected the data in one area where the park near to the school to let me selected the participant easily. Therefore, my data may not be very representative to conduct research on and represent all children in Hong Kong. However, I believe these data will provide a basic framework for the future researchers with a good basis for more in-depth research.

Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

Chapter 8: Conclusion

In summary, children used smartphones and iPad as their main learning tools. However, most children and their family have negative habit to use that may affect their cognitive development, such as parents failing to accompany their children when using electronic media and allowing children to use electronic media while eating, which affects their cognitive abilities.

However, electronic media also has positive impact on learning. Children can learn use it to learn anytime and anywhere through the simple mobile phone and iPad. And with the development and innovation of science and technology, the content of E-learning is becoming more and more diversified. It can be seen that the trend of electronic media helping Hong Kong children learn will become more and common, are even promoting E-books to replace traditional textbooks in the future of the education industry.

Recommendation

Therefore, based on the trends derived from this study, I suggest the government can popularize E-books to provide children with a more innovative and comprehensive learning experience.

In addition, this study also concluded that there is a significant positive correlation between children's learning and language development and parent companionship. Therefore, when children use E-books in the future. Parents can try to accompany with them. More importantly, to develop good electronic media usage

habits to children to assisting their learning. It also lay a foundation for the education sector or the government to propose the policy of "Promoting E-books in the education industry to replace the traditional textbook".

Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

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Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

Appendices

Questionnaire

1. What is your gender? *
   您的性別？

   Mark only one oval.

   - ◯ Male 男
   - ◯ Female 女

2. How old are you? *
   您的年齡？

   Mark only one oval.

   - ◯ 1-5 years old 歲
   - ◯ 6-10 years old 歲
   - ◯ 11-15 years old 歲
   - ◯ 16-17 years old 歲

3. What is your education level? *
   您的教育程度？

   Mark only one oval.

   - ◯ Pre-schooler 學齡前兒童
   - ◯ Kindergarten 幼稚園
   - ◯ Primary school 小學
   - ◯ Secondary school 中學

4. What is your parent's education level? *
您父母的教育程度？

Mark only one oval.

- Primary 小學
- Secondary 中學
- University / College 大學/專上學院
- Professional / Others 專業/其他

The situation of Children's Use of Electronic Media 兒童使用電子媒體的情況

5. How old when you exposed electronic media for the first time? *
您第一次接觸電子媒體的年齡？

Mark only one oval.

- 1-5 years old 歲
- 6-10 years old 歲
- 11-15 years old 歲
- 16-17 years old 歲

6. What electronic media do you use the most ? *

您最常使用的電子媒體是什麼？

Mark only one oval.

- Mobile phone 手機
- Computer 電腦
- Ipad 平板電腦
- TV 電視
- Console 遊戲機

7. What is your primary use of electronic media? *
您使用電子媒體的最主要的用途是什麼？

Mark only one oval.

- ◯ Watch TV/Movie/Video 看電視/電影/影片
- ◯ Study 學習
- ◯ Play game 玩遊戲
- ◯ FaceTime/social 視像通訊/社交

8. How much time do you spend using electronic media on an average day? *

您平均每天花多少時間使用電子媒體？

Mark only one oval.

- ◯ Within 1 hour 1小時內
- ◯ 1-4 hours 小時
- ◯ 5-8 hours 小時
- ◯ 9-11 hours 小時
- ◯ 12 hours or above 12小時或以上

9. Do you use electronic media while eating? *
您用餐時，會使用電子媒體嗎？

Mark only one oval.

- ◯ Yes 會
- ◯ No 不會

10. Do you use electronic media before going to bed? *
您睡前會使用電子媒體嗎？

Mark only one oval.

- ◯ Yes 會
- ◯ No 不會

11. When you use electronic media, do your parents watch or discuss the content with you? *
您使用電子媒體時，您的父母會與您一起觀看或討論內容嗎？

Mark only one oval.

- ◯ Yes 會
- ◯ No 不會

The situation on Impact of cognitive development 認知發展的影響情況

12. In your daily life, do you agree that your ability to learn new things has increased? *
在日常生活中，你同意您學習新事物的能力增強嗎？

Mark only one oval.

- ◯ Strongly agree 非常同意
- ◯ Agree 同意
- ◯ Neutral 一般
- ◯ Disagree 不同意
- ◯ Strongly disagree 非常不同意

13. Do you understand and apply new vocabulary and concepts learned from electronic media? *
您能理解和運用從電子媒體中學到的新詞彙和概念？

Mark only one oval.

- Strongly agree 非常同意
- Agree 同意
- Neutral 一般
- Disagree 不同意
- Strongly disagree 非常不同意

14. Do you express your needs and feelings to others clearly? *
您能向別人清晰表達需要和感受嗎？

Mark only one oval.

- Strongly agree 非常同意
- Agree 同意
- Neutral 一般
- Disagree 不同意
- Strongly disagree 非常不同意

15. When you study, do you stay focused until things are done? *
當學習時，您能保持集中和專注，直到事情完成爲止嗎？

Mark only one oval.

- Strongly agree 非常同意
- Agree 同意
- Neutral 一般
- Disagree 不同意
- Strongly disagree 非常不同意

16. At school, do you comply with the teacher's requirements? *
在學校，您遵守老師的要求嗎？

Mark only one oval.

- Strongly agree 非常同意
- Agree 同意
- Neutral 一般
- Disagree 不同意
- Strongly disagree 非常不同意

17. Do you think your memory is good? *
您認為您的記憶力不錯嗎？

Mark only one oval.

- Strongly agree 非常同意
- Agree 同意
- Neutral 一般
- Disagree 不同意
- Strongly disagree 非常不同意

18. Do you think your academic performance is good? *
您認為您的學業成績不錯嗎？

Mark only one oval.

- Strongly agree 非常同意
- Agree 同意
- Neutral 一般
- Disagree 不同意
- Strongly disagree 非常不同意

Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

Table and charts

Table1

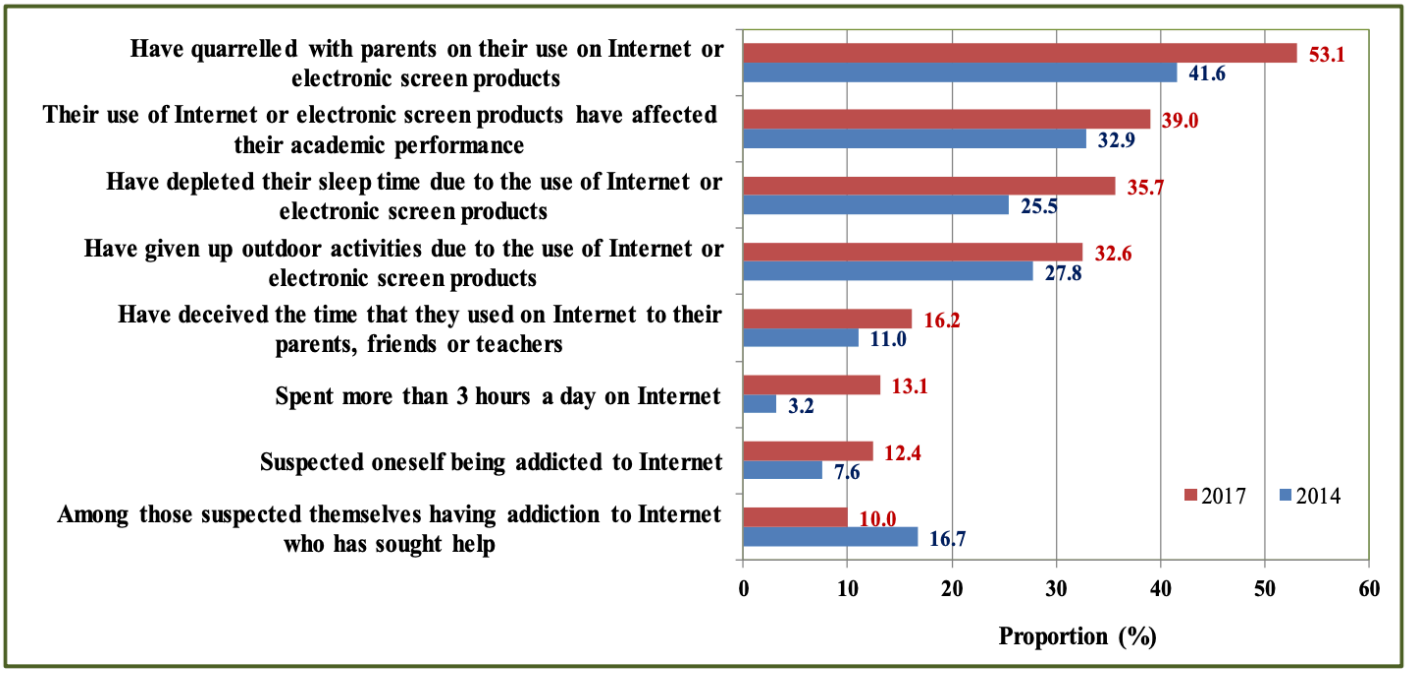
Table 1: Usage pattern of different electronic screen media among preschool children, 2017 and 2014

Type of electronic screen media	Prevalence of use (%)		Median age of starting to use (months)		Average viewing time per day (minutes)	
	2017	2014	2017	2014	2017	2014
TV	73.5	78.4	12	8	38.4	44.2
Smartphone*	43.7	*	12	*	25.6	*
Tablet	24.9	38.4	18	16	34.2	31.6
DVD	14.2	44.4	12	10	33.0	38.8
Computer	10.7	33.6	24	24	27.8	31.8

Note: * Not specifically asked in 2014.

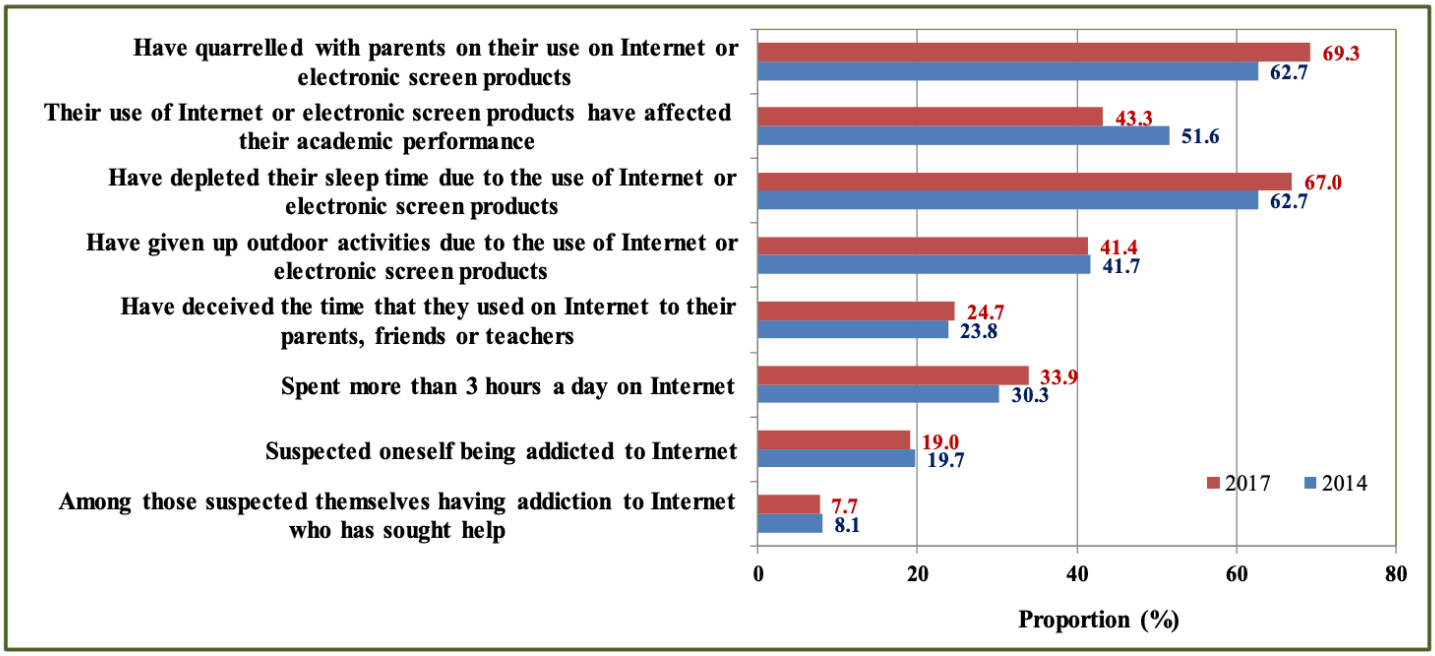
Source: Family Health Service, Department of Health.

Figure 2: Issues associated with the use of Internet or electronic screen products as claimed by the surveyed primary school students, 2017 and 2014



Source: Student Health Service, Department of Health.

Figure 3: Issues associated with the use of Internet or electronic screen products as claimed by the surveyed secondary school students, 2017 and 2014



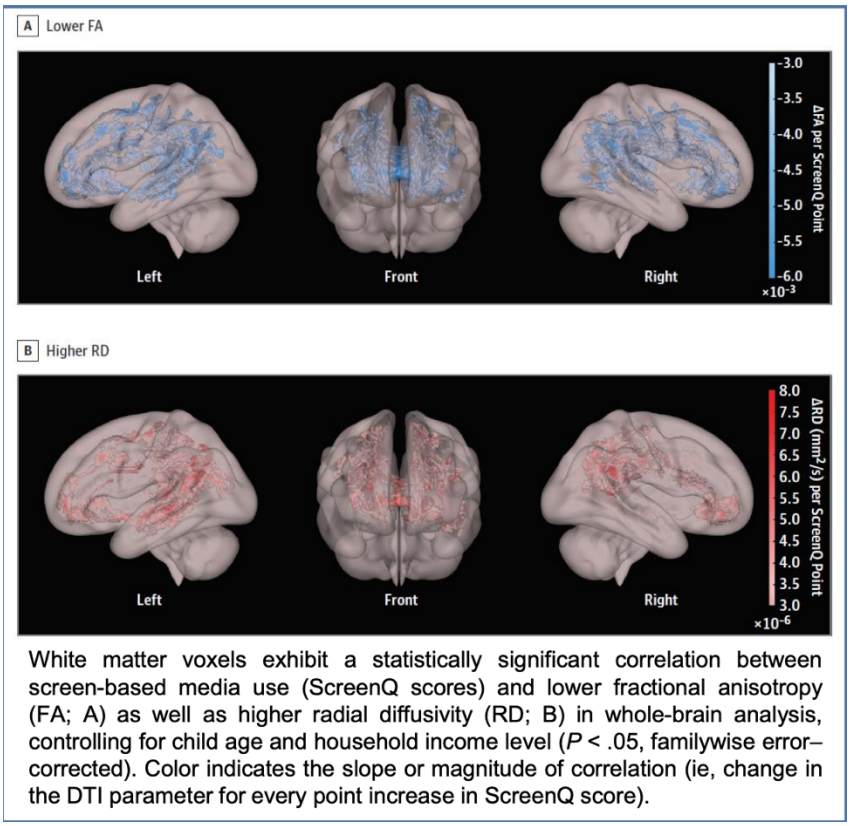
Source: Student Health Service, Department of Health.

Figure 4

	平日使用時間（非學習/工作用途）	假日使用時間（非學習/工作用途）
家長	3.0小時	3.3小時
小學生	4.0小時	6.0小時
初小（小一至小三）	3.4小時	5.0小時
高小（小四至小六）	5.2小時	8.2小時

Figure 5

Figure 6



White matter voxels exhibit a statistically significant correlation between screen-based media use (ScreenQ scores) and lower fractional anisotropy (FA; A) as well as higher radial diffusivity (RD; B) in whole-brain analysis, controlling for child age and household income level ($P < .05$, familywise error–corrected). Color indicates the slope or magnitude of correlation (ie, change in the DTI parameter for every point increase in ScreenQ score).

Table 7

Research of Zhang Jianru (2021)

幼兒電子產品使用時間與其發展之相關分析

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
（1）電視時間	--	.181**	-.043*	-.130**	-.138**	-.023	-.107**	-.062**	-.063**	-.063**	-.022	-.129**
（2）其他電子產品時間			-.043*	-.136**	-.130**	-.023	-.095**	-.015	-.057**	-.029	-.039	-.100**
（3）語言理解				.570**	.454**	.424**	.454**	.296**	.452**	.451**	.327**	.403**
（4）語言表達					.554**	.480**	.534**	.425**	.599**	.548**	.383**	.538**
（5）讀寫萌發						.445**	.554**	.318**	.455**	.468**	.379**	.480**
（6）粗大動作							.642**	.301**	.430**	.464**	.356**	.401**
（7）精細動作								.295**	.433**	.471**	.372**	.459**
（8）情緒覺察									.488**	.514**	.348**	.442**
（9）情緒表達										.618**	.416**	.440**
（10）情緒理解											.490**	.480**
（11）情緒調節												.456**
（12）注意力／執行功能												--

*$p < .05$. **$p < .01$.

Table 8

Background information of children and family

Item	Group	Frequency	Percent (%)
Gender	Female	28	53.8
	Male	24	46.2
Age	1-5 years old	34	65.4
	6-10 years old	10	19.2
	11-15 years old	3	5.8
	16-17 years old	5	9.6
Education level	Pre-schooler	13	25
(Children)	Kindergarten	21	40.4
	Primary school	10	19.2
	Secondary school	8	15.4
Education level	Primary school	0	0
(Parent)	Secondary school	23	44.2
	University / College	25	48.1
	Professional / Other	4	7.7

Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

Table 9

Frequencies of the situation in habit and pattern of children use the electronic media in Hong Kong

The situation of Children's Use of Electronic Media

Item	Group	Frequency	Percent (%)
How old were you when you exposed electronic media for the first time?	1-5 years old	48	92.3
	6–10 years old	4	7.7
	11-15 years old	0	0
	16-17 years old	0	0
What electronic media do you use the most?	Mobile phone	21	40.4
	Computer	1	1.9
	IPad	21	40.4
	TV	8	15.4
	Console	1	1.9
What is your primary use of electronic media?	Watch TV/Movie/Video	27	51.9
	Study	11	21.2
	Play game	14	26.9
	FaceTime/social	0	0
How much time do you spend using electronic media on an average day?	Within 1 hour	7	13.5
	1-4 hours	37	71.2
	5-8 hours	8	15.4
	9-11 hours	0	0
	12 hours or above	0	0
Do you use electronic media while eating?	Yes	33	63.5
	No	19	36.5
Do you use electronic media before going to bed?	Yes	30	57.7
	No	22	42.3
When you use electronic media, do your parents watch or discuss the content with you?	Yes	16	30.8
	No	26	69.2

Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

Table 10

Frequencies of the impact of cognitive development on children use the electronic media in Hong Kong

The situation on Impact of cognitive development

Item	Group	Frequency	Percent (%)
In your daily life, do you agree that your ability to learn new things has increased?	Strongly agree	3	5.8
	Agree	30	57.7
	Neutral	18	34.6
	Disagree	1	1.9
	Strongly disagree	0	0
Do you understand and apply new vocabulary and concepts learned from electronic media?	Strongly agree	2	3.8
	Agree	39	75
	Neutral	9	17.3
	Disagree	2	3.8
	Strongly disagree	0	0
Do you express your needs and feelings to others clearly?	Strongly agree	0	0
	Agree	22	42.3
	Neutral	29	55.8
	Disagree	1	1.9
	Strongly disagree	0	0
When you study, do you stay focused until things are done?	Strongly agree	1	1.9
	Agree	16	30.8
	Neutral	20	38.5
	Disagree	15	28.8
	Strongly disagree	0	0
At school, do you comply with the teacher's requirements?	Strongly agree	0	0
	Agree	27	51.9
	Neutral	22	42.3
	Disagree	3	5.8
	Strongly disagree	0	0
Do you think your memory is good?	Strongly agree	0	0
	Agree	23	44.2
	Neutral	28	53.8
	Disagree	1	1.9
	Strongly disagree	0	0
Do you think your academic performance is good?	Strongly agree	0	0
	Agree	22	42.3
	Neutral	26	50
	Disagree	4	7.7
	Strongly disagree	0	0

Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

Table11

Correlation between children's age of using electronic media and cognitive development in Hong Kong

Correlations

		Age	Learning (Knowledge)	Learning (Academic Performance)	Language (Vocabulary)	Language (Expression)	Attention	Execution ability	Memory
Age	Pearson Correlation	1	.549**	.379**	.191	.020	.092	-.122	.491**
	Sig. (2-tailed)		<.001	.006	.174	.891	.516	.389	<.001
	N	52	52	52	52	52	52	52	52
Learning (Knowledge)	Pearson Correlation	.549**	1	.504**	.522**	.290*	.422**	.148	.603**
	Sig. (2-tailed)	<.001		<.001	<.001	.037	.002	.294	<.001
	N	52	52	52	52	52	52	52	52
Learning (Academic Performance)	Pearson Correlation	.379**	.504**	1	.540**	.515**	.608**	.656**	.844**
	Sig. (2-tailed)	.006	<.001		<.001	<.001	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52
Language (Vocabulary)	Pearson Correlation	.191	.522**	.540**	1	.414**	.524**	.567**	.489**
	Sig. (2-tailed)	.174	<.001	<.001		.002	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52
Language (Expression)	Pearson Correlation	.020	.290*	.515**	.414**	1	.658**	.501**	.419**
	Sig. (2-tailed)	.891	.037	<.001	.002		<.001	<.001	.002
	N	52	52	52	52	52	52	52	52
Attention	Pearson Correlation	.092	.422**	.608**	.524**	.658**	1	.530**	.563**
	Sig. (2-tailed)	.516	.002	<.001	<.001	<.001		<.001	<.001
	N	52	52	52	52	52	52	52	52
Execution ability	Pearson Correlation	-.122	.148	.656**	.567**	.501**	.530**	1	.531**
	Sig. (2-tailed)	.389	.294	<.001	<.001	<.001	<.001		<.001
	N	52	52	52	52	52	52	52	52
Memory	Pearson Correlation	.491**	.603**	.844**	.489**	.419**	.563**	.531**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	.002	<.001	<.001	
	N	52	52	52	52	52	52	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Research on "The impact of electronic media on the children's cognitive development in Hong Kong"

Table 12

Correlation between children spent time on electronic media and cognitive development in Hong Kong

Correlations

		Average time spent using electronic media per day	Learning (Knowledge)	Learning (Academic Performance)	Language (Vocabulary)	Language (Expression)	Attention	Execution ability	Memory
Average time spent using electronic media per day	Pearson Correlation	1	.567**	.369**	.303*	.231	.265	.027	.433**
	Sig. (2-tailed)		<.001	.007	.029	.100	.057	.847	.001
	N	52	52	52	52	52	52	52	52
Learning (Knowledge)	Pearson Correlation	.567**	1	.504**	.522**	.290*	.422**	.148	.603**
	Sig. (2-tailed)	<.001		<.001	<.001	.037	.002	.294	<.001
	N	52	52	52	52	52	52	52	52
Learning (Academic Performance)	Pearson Correlation	.369**	.504**	1	.540**	.515**	.608**	.656**	.844**
	Sig. (2-tailed)	.007	<.001		<.001	<.001	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52
Language (Vocabulary)	Pearson Correlation	.303*	.522**	.540**	1	.414**	.524**	.567**	.489**
	Sig. (2-tailed)	.029	<.001	<.001		.002	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52
Language (Expression)	Pearson Correlation	.231	.290*	.515**	.414**	1	.658**	.501**	.419**
	Sig. (2-tailed)	.100	.037	<.001	.002		<.001	<.001	.002
	N	52	52	52	52	52	52	52	52
Attention	Pearson Correlation	.265	.422**	.608**	.524**	.658**	1	.530**	.563**
	Sig. (2-tailed)	.057	.002	<.001	<.001	<.001		<.001	<.001
	N	52	52	52	52	52	52	52	52
Execution ability	Pearson Correlation	.027	.148	.656**	.567**	.501**	.530**	1	.531**
	Sig. (2-tailed)	.847	.294	<.001	<.001	<.001	<.001		<.001
	N	52	52	52	52	52	52	52	52
Memory	Pearson Correlation	.433**	.603**	.844**	.489**	.419**	.563**	.531**	1
	Sig. (2-tailed)	.001	<.001	<.001	<.001	.002	<.001	<.001	
	N	52	52	52	52	52	52	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

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Table 13

Correlation between children's family factors of using electronic media and cognitive development in Hong Kong

Correlations

		Using electronic media while eating	Using electronic media before sleep	Using electronic media with parent	Learning (Knowledge)	Learning (Academic Performance)	Language (Vocabulary)	Language (Expression)	Attention	Execution ability	Memory
Using electronic media while eating	Pearson Correlation	1	.159	−.273	−.275*	−.222	−.142	−.251	−.142	−.081	−.223
	Sig. (2-tailed)		.262	.050	.048	.114	.314	.072	.316	.566	.113
	N	52	52	52	52	52	52	52	52	52	52
Using electronic media before sleep	Pearson Correlation	.159	1	−.441**	−.458**	−.529**	−.320*	−.377**	−.415**	−.119	−.490**
	Sig. (2-tailed)	.262		.001	<.001	<.001	.021	.006	.002	.400	<.001
	N	52	52	52	52	52	52	52	52	52	52
Using electronic media with parent	Pearson Correlation	−.273	−.441**	1	.425**	.504**	.396**	.358**	.462**	.388**	.645**
	Sig. (2-tailed)	.050	.001		.002	<.001	.004	.009	<.001	.004	<.001
	N	52	52	52	52	52	52	52	52	52	52
Learning (Knowledge)	Pearson Correlation	−.275*	−.458**	.425**	1	.504**	.522**	.290*	.422**	.148	.603**
	Sig. (2-tailed)	.048	<.001	.002		<.001	<.001	.037	.002	.294	<.001
	N	52	52	52	52	52	52	52	52	52	52
Learning (Academic Performance)	Pearson Correlation	−.222	−.529**	.504**	.504**	1	.540**	.515**	.608**	.656**	.844**
	Sig. (2-tailed)	.114	<.001	<.001	<.001		<.001	<.001	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52	52	52
Language (Vocabulary)	Pearson Correlation	−.142	−.320*	.396**	.522**	.540**	1	.414**	.524**	.567**	.489**
	Sig. (2-tailed)	.314	.021	.004	<.001	<.001		.002	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52	52	52
Language (Expression)	Pearson Correlation	−.251	−.377**	.358**	.290*	.515**	.414**	1	.658**	.501**	.419**
	Sig. (2-tailed)	.072	.006	.009	.037	<.001	.002		<.001	<.001	.002
	N	52	52	52	52	52	52	52	52	52	52
Attention	Pearson Correlation	−.142	−.415**	.462**	.422**	.608**	.524**	.658**	1	.530**	.563**
	Sig. (2-tailed)	.316	.002	<.001	.002	<.001	<.001	<.001		<.001	<.001
	N	52	52	52	52	52	52	52	52	52	52
Execution ability	Pearson Correlation	−.081	−.119	.388**	.148	.656**	.567**	.501**	.530**	1	.531**
	Sig. (2-tailed)	.566	.400	.004	.294	<.001	<.001	<.001	<.001		<.001
	N	52	52	52	52	52	52	52	52	52	52
Memory	Pearson Correlation	−.223	−.490**	.645**	.603**	.844**	.489**	.419**	.563**	.531**	1
	Sig. (2-tailed)	.113	<.001	<.001	<.001	<.001	<.001	.002	<.001	<.001	
	N	52	52	52	52	52	52	52	52	52	52

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

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Table 14

Correlation between time spent on electronic media and cognitive development

Correlations

		Average time spent using electronic media per day	Learning (Knowledge)	Learning (Academic Performance)	Language (Vocabulary)	Language (Expression)	Attention	Execution ability	Memory
Average time spent using electronic media per day	Pearson Correlation	1	.567**	.369**	.303*	.231	.265	.027	.433**
	Sig. (2-tailed)		<.001	.007	.029	.100	.057	.847	.001
	N	52	52	52	52	52	52	52	52
Learning (Knowledge)	Pearson Correlation	.567**	1	.504**	.522**	.290*	.422**	.148	.603**
	Sig. (2-tailed)	<.001		<.001	<.001	.037	.002	.294	<.001
	N	52	52	52	52	52	52	52	52
Learning (Academic Performance)	Pearson Correlation	.369**	.504**	1	.540**	.515**	.608**	.656**	.844**
	Sig. (2-tailed)	.007	<.001		<.001	<.001	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52
Language (Vocabulary)	Pearson Correlation	.303*	.522**	.540**	1	.414**	.524**	.567**	.489**
	Sig. (2-tailed)	.029	<.001	<.001		.002	<.001	<.001	<.001
	N	52	52	52	52	52	52	52	52
Language (Expression)	Pearson Correlation	.231	.290*	.515**	.414**	1	.658**	.501**	.419**
	Sig. (2-tailed)	.100	.037	<.001	.002		<.001	<.001	.002
	N	52	52	52	52	52	52	52	52
Attention	Pearson Correlation	.265	.422**	.608**	.524**	.658**	1	.530**	.563**
	Sig. (2-tailed)	.057	.002	<.001	<.001	<.001		<.001	<.001
	N	52	52	52	52	52	52	52	52
Execution ability	Pearson Correlation	.027	.148	.656**	.567**	.501**	.530**	1	.531**
	Sig. (2-tailed)	.847	.294	<.001	<.001	<.001	<.001		<.001
	N	52	52	52	52	52	52	52	52
Memory	Pearson Correlation	.433**	.603**	.844**	.489**	.419**	.563**	.531**	1
	Sig. (2-tailed)	.001	<.001	<.001	<.001	.002	<.001	<.001	
	N	52	52	52	52	52	52	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

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Table 15

Compare the result for the correlation of the language development between the time spend on using electronic media and family factors

Correlations

		Language (Vocabulary)	Language (Expression)	Average time spent using electronic media per day	Using electronic media with parent
Language (Vocabulary)	Pearson Correlation	1	.414**	.303*	.396**
	Sig. (2-tailed)		.002	.029	.004
	N	52	52	52	52
Language (Expression)	Pearson Correlation	.414**	1	.231	.358**
	Sig. (2-tailed)	.002		.100	.009
	N	52	52	52	52
Average time spent using electronic media per day	Pearson Correlation	.303*	.231	1	.334*
	Sig. (2-tailed)	.029	.100		.015
	N	52	52	52	52
Using electronic media with parent	Pearson Correlation	.396**	.358**	.334*	1
	Sig. (2-tailed)	.004	.009	.015	
	N	52	52	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).