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Article

Appropriate Usage of Smartphone by Infants

–Frequency of smartphone usage and its relevant factors–

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I. The abstract and objective of this study

Children acquire the ability to linguistically express objects and events that are present before their eyes around age of one year. They then gradually become able to recollect non-present events and to respond to a linguistic expression with a linguistic expression. In such course of the development of linguistic ability in an infant, communication of knowledge and emotions using both linguistic and nonlinguistic expressions plays an important role (Toyama, Hisano, Chinen & Satake, 1994). Vocabulary development is essential to the development of linguistic ability; studies surmise that children's active and voluntary interaction with their parents and close adults help build their vocabulary, thereby promoting their language development (Uchida, 1999).

However, the world is facing a difficult situation in which parent-child communication is at stake: popularization of smartphones. Due to its convenience and availability in a multitude of everyday situations, regardless of indoor or outdoor, as well as time range, it is popularly considered as a highly versatile tool among parents and guardians with babies and little children (Onishi, Hirano & Saeki, 2017). Studying how parents and their children in early childhood spend time in the waiting area or public space on a train or at an airport in Japan, Taiwan and South Korea, Tokuda , Nishimura & Mizuno (2019) has confirmed that the ratio of parents who allow their children to use a smartphone is higher and the ratio of parents that play word games (riddles and quizzes) or hand games, or read to their children is lower in Japan as compared to Taiwan and South Korea.

In addition to the deprivation of communication, other issues pertaining to infants' usage of smartphones have been pointed out. The age at which adolescents develop internet addiction is becoming increasingly low and has become an object of public concern. There have been cases in which infants consult a psychiatrist due to their smartphone addiction (Masuda, 2019). Reports indicate that an increase in the frequency of smartphone usage deteriorates the quality of sleep and causes children to get irritated easily or act in an aggressive manner (Masuda, Yamashita, Matsumoto, Masuda & Munemoto, 2019). Side effects of smartphone addiction include bad posture and failing eyesight (Koto, Nakazawa & Kunikane, 2019; Inoue, 2015).

From the above, children's smartphone usage not only physically decreases the amount of parent-child communication but also prevents children from actively and

voluntarily interacting with adults which could put a strain on children's language development. We have conducted a series of studies to clarify what kind of effects smartphone usage has on the language development of children in early childhood. In this paper, as its basic reference material, we are going to determine how parents are allowing their children to use their smartphone, parents' understanding of children's smartphone usage and factors pertaining to children's high smartphone usage frequency by surveying parents and guardians whose children are currently attending kindergarten or nursery school.

Ⅱ. Method

(1) Research Subject

650 parents having kindergartens, nurseries or certified daycare centers children in Tokyo Prefecture, Chiba Prefecture and Ibaraki Prefecture (6 place) responded to the questionnaires and response was received from 447 parents (69% collection rate). We excluded the response with incompletion and analyzed the 432 responses (66% valid response rate).

(2) Research procedure

The principals of the kindergarten, nurseries and certified daycare centers were requested to cooperate the survey, and questionnaires were sent to them who consented. The questionnaires and the explanatory leaflets were distributed by the classroom teachers to the parents. The parents read the leaflets and those who consented answered the questionnaires at home. After that, the questionnaires were collected at the kindergartens, nurseries or certified daycare centers, and sent back. The surveyees were requested not to write their name even on the return envelope. Therefore, this research was self-filled anonymous survey.

The study period was between July, 2019 and 9, 2019.

(3) Ethical Considerations

This survey was conducted after obtaining the approval of the Ethics Committee of the University of Tsukuba Faculty of Medicine (approval number: 1347).

Ⅲ. Result and study

(1) Attribute of the subject

The ratio of fathers to mothers was 3% (14) to 97% (418). The age distribution among 20s, 30s and 40s and older was 2% (11), 59% (254) and 39% (167), and the distribution of number of children among 1, 2, 3, 4 or more, and no response was 18% (80), 60% (257), 17% (75), 4% (18) and 1% (2), respectively. The distribution of family members living with the child included: 94% mother (407), 94% father (406), 14% grandmother (61), 12% grandfather (52), 2% uncle and aunt (9) and 5% other (21).

(2) Smartphone usage status of the subject

A five-level Likert scale from “very frequently” to “not at all” was employed to survey the frequency of daily smartphone (including flip phone) usage of the subject. The result showed high frequency usage with a score of 4.14 (SD=0.89). The survey result of the purpose of smartphone usage is indicated in Table 1. According to the table, dominant purposes were “taking and looking at photos” (92%), “using social media (LINE, Twitter, Facebook, etc.)” (85%), “reading newspaper articles” (82%) and “reading/writing emails” (69%).

The average scores for questions “Do you use your smartphone while eating with your child(ren)?” and “Do you use your smartphone when talking while talking with your child(ren)?” also asked employing a five-level Likert scale were 2.07 (SD=0.98) and 2.44 (SD=0.97), respectively, signifying that the surveyee do not engage in such behaviors.

(3) Children’s smartphone usage status

A five-level Likert scale from “very frequently” to “not at all” was again employed to survey the frequency of children’s (if the subject family had multiple children, the surveyee of this survey is children in early childhood) daily smartphone (including tablet) usage. The average score was 2.58 (SD=1.10) of relatively low frequency. Asking about the frequency of TV and DVD usage in the same scale, the average score was 3.60 (SD=1.01). The average score of the frequency of reading illustrated books was 3.13(SD=1.04). Smartphones were found to be used less frequently than TVs, DVDs and illustrated books.

In the survey asking about children’s purpose of smartphone usage, “taking and looking at photos” dominated the responses (Table 2). More than half of the children surveyed was found to be watching videos using a smartphone.

Asking about the situations in which children use a smartphone, the most popular response was “when sharing photos, videos and music with family” (Table 3). On the other hand, there was a significant amount of surveyees checking “to pass time when traveling or waiting”, “to keep child(ren) quiet in public space” and “when the parent is busy doing housework etc.” It could be inferred from the response that parents give their smartphone to their children to keep them quiet and children are left to use the smartphone on their own. I was also able to confirm that “when child(ren) wish(es) to use one” accounted for 30% of all reasons that trigger children’s smartphone usage, meaning that a good percentage of children’s smartphone usage is children-led.

With respect to the rules for children’s smartphone usage, more than 70% of families have laid down a rule to “seek permission of an adult before using a smartphone” (Table 4). Approximately 40% of families had rules concerning screen time, usage purpose and allowed time range such as “limited screen time (number of minutes per session or day)”, “limited usage purpose (apps, websites, etc.)” and “limited time of the day during

which smartphone usage is allowed (e.g. no smartphone during a meal)".

Meanwhile, the percentage of families that "allow child(ren) to use a smartphone only when accompanied an adult (no smartphone to be left with just children)" stayed relatively low at 30%.

Table1. The subject's purpose of smartphone usage (multiple answer) N=432

	%	n
Taking and looking at photos	92%	397
Using social media	85%	369
Reading newspaper articles	82%	353
Reading/writing emails	69%	296
Watching videos	53%	230
Listening to music	38%	163
Playing games	31%	135
Other	18%	79

Table 2. Children's purpose of smartphone usage (multiple answer) N=432

	%	n
Taking and looking at photos	62%	268
Using social media	57%	245
Playing with educational apps for infants	26%	113
Playing games (designed for all ages including adults)	19%	80
Video calling	13%	56
Reading illustrated books on the moving Illustrated book website	3%	11
No particular purpose	2%	9
Other	6%	26

Table 3. Occasion for children's smartphone usage (multiple answer) N=432

	%	n
When sharing photos, videos and music with family	40%	174
To pass time when traveling or waiting	34%	146
When child(ren) wish(es) to use one	30%	129
To keep child(ren) quiet in public space	29%	127
When the parent is busy doing housework etc.	26%	113
When a parent wants child(ren) to stay or sit still during a meal etc.	4%	15
When calming child(ren)'s excitement or disturbance	3%	13
Other	8%	36

Table 4. Rules for children's smartphone usage (multiple answer) N=432

	%	n
Seek permission of an adult before using a smartphone	71%	305
Limited usage purpose	41%	178
Limited screen time	41%	176
Limited time of the day during which smartphone usage is allowed	37%	158
Allow child(ren) to use a smartphone only when accompanied an adult	28%	121
No specific rules	5%	22
Child(ren) is/are to comment on their experience with smartphone after finishing using	1%	4
Other	2%	9

(4) The subject's understanding of children's smartphone usage

A five-level Likert scale from "strongly agree" to "strongly disagree" was used to survey the subject's opinion on children's smartphone usage shown in Table 5. As a result, "uncontrolled smartphone usage starting at a young age can develop smartphone addiction" won approval of many surveyees. However, "long hours of smartphone usage delays children's language development" did not gain much support. Positive aspects of children's smartphone usage such as "child(ren) can do some research on their own using a smartphone" and "child(ren) can develop vocabulary using a smartphone" gained considerable amount of support.

(5) Communication within family

A five-level Likert scale from "very frequently" to "not at all" was employed to survey the frequency of children taking the initiative to start a conversation with their family members (higher the score, higher the frequency of children communicating). The average score was 3.84 (SD=1.00). A five-level Likert scale from "very likely" to "very unlikely" was employed to survey the likelihood of children voluntarily joining the conversation among other family members. The average score was 4.46 (SD=0.78), meaning that children are actively communicating with their family members.

A five-level Likert scale from "strongly agree" to "strongly disagree" was employed to survey whether parents feel that opportunities to communicate with their children have decreased. The average score was 1.91 (SD=1.01) and it was found that parents do not really feel that children's smartphone usage reduces the amount of communication with their children.

Table 5. Parents' opinion on children's smartphone usage

	M	SD
Uncontrolled smartphone usage starting at a young age can develop smartphone addiction	4.3	0.86
Smartphone deprives children of communication with adults	3.8	1.02
Child(ren) can do some research on their own using a smartphone	3.7	0.87
Child(ren) can develop vocabulary using a smartphone	3.5	0.99
Smartphone warps children's character, causing them to become antisocial	3.3	1.07
Long hours of smartphone usage delays children's language development	3.0	1.13

(6) Factors related to the frequency of children's smartphone usage

A multiple regression analysis was conducted, letting the frequency of children's smartphone usage be the dependent variable; and letting the subject's smartphone usage status (frequency of usage and smartphone usage during a meal and conversation with children), frequency of children watching TV or DVD and reading illustrated books, children's purpose of smartphone usage, triggers to children's smartphone usage, rules for children's smartphone usage, the subject's understanding of children's smartphone usage, and communication within family (whether children take the initiative to talk to their family and children's smartphone usage reduces parent-child communication) be the explanatory variable (Table 6). A step-wise selection was used for this multiple regression analysis.

According to the tables, households in which children use smartphones for "playing games", "watching videos" and "playing with educational apps for infants" showed higher frequency of children's smartphone usage. Unless parents limit screen time, children would use smartphones for games, videos and educational apps endlessly. While "taking and looking at photos" dominated the responses for the question asking about children's smartphone usage purpose as mentioned above, it did not lead to an increase in the frequency of smartphone usage.

Households in which parents give their smartphone to their children "to pass time when traveling or waiting", "to keep child(ren) quiet in public space" and "when the parent is busy doing housework etc." were found to have higher children's smartphone usage frequency. Taking the irrelevance of smartphone usage "when sharing photos, videos and music with family" and the frequency of smartphone usage into consideration, it can be inferred that children's smartphone usage increases as parents allow them to use one alone, instead of parents and children using a smartphone together.

With regard to the rules for children's smartphone usage, households that ensure children to "seek permission of an adult before using a smartphone" or "use a smartphone only when accompanied an adult" were found to have lower children's

smartphone usage frequency. It can be said that having a parental control over children's smartphone usage reduces its frequency. On the contrary, households that lay down "limited time of the day during which smartphone usage is allowed (e.g. no smartphone during a meal)" had higher usage frequency. In this case, households with such rule applied to only a few specific occasions are in fact allowing a wider time range within a day during which smartphone usage is not limited.

Households that agreed with the statement "long hours of smartphone usage delays children's language development" had lower children's smartphone usage frequency. While the ratio of surveyees that agreed with this statement was not high (M=3.0). Households with such understanding of children's smartphone usage tend to keep smartphones away from children, hence the low usage frequency.

Table 6. Factors related to the frequency of children's smartphone usage

explanatory variable	β
Children's purpose of smartphone usage: Using social media	0.195**
Children's purpose of smartphone usage: Playing games (designed for all ages including adults)	0.141**
Children's purpose of smartphone usage: Playing with educational apps for infants	0.121**
Occasion for children's smartphone usage: When the parent is busy doing housework etc.	0.245**
Occasion for children's smartphone usage: When child(ren) wish(es) to use one	0.157**
Occasion for children's smartphone usage: To pass time when traveling or waiting	0.120**
Rules for children's smartphone usage: Limited time of the day during which smartphone usage is allowed	0.156**
Rules for children's smartphone usage: Seek permission of an adult before using a smartphone	-0.134**
Rules for children's smartphone usage: Allow child(ren) to use a smartphone only when accompanied an adult	-0.096*
Opportunities to communicate with their children have decreased	0.103*
Parents' opinion on children's smartphone usage: Long hours of smartphone usage delays children's language development	-0.201**
R^2	0.464**

** : p< .01, * : p< .05

Ⅳ. Conclusion

The study had confirmed the relation between children's smartphone usage and their smartphone usage purpose, situation and rules. In the present-day world in which smartphones have been popularized, it is unrealistic to prevent children from using a smartphone at all. Each household is responsible for their children's interaction with smartphones and must take measures accordingly.

This can be compared to the talk on how much of children's exposure to TVs and DVDs should be allowed. Parents choose which TV and DVD program to show to their children for how much time, and it promotes children's intellectual development by sharing thoughts after watching (Tokuda & Mizuno, 2009). To be more specific, studies advise parents to choose a program designed for children in simple language and that duration of each session should be no longer than 15 minutes even if the audience is a five-year old and parents should share thoughts with their children on the program content. Providing children with appropriate educational material in line with such rule, studies have shown that children are able to build vocabulary, obtain information and develop sociality from videos and even cultivate sensibility from videos through various music and graphic effects (Tokuda, Mizuno, Nishidate & Matsushita, 2010).

Although there is much to be discussed regarding the promotion of children's intellectual development through use of smartphone, high usage frequency is definitely inappropriate for children.

The results of this study suggest that parents must be aware of the following guidelines when allowing children to use their smartphone:

- Decide screen time when using a smartphone for games, videos and educational apps before using
- Think about other ways for children to spend time instead of immediately giving a smartphone to children when you are busy or need to pass time when traveling or waiting
- Do not give your smartphone to children and allow them to use freely every time they ask for one
- Lay down a rule that using a smartphone requires permission of an adult and only allow children's use of smartphone when accompanied by an adult
- Invite children to use a smartphone together, instead of leaving them alone with one

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Appropriate Usage of Smartphone by Infants

−Frequency of smartphone usage and its relevant factors−

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The purpose of this paper was to determine how parents are allowing their children to use their smartphone, parents' understanding of children's smartphone usage and factors pertaining to children's high smartphone usage frequency by surveying parents and guardians whose children are currently attending kindergarten or nursery school.

Research Subject were 432 parents having kindergartens, nurseries or certified daycare centers children.

Households in which children use smartphones for "playing games", "watching videos" and "playing with educational apps for infants" showed higher frequency of children's smartphone usage. Also, households in which parents give their smartphone to their children "to pass time when traveling or waiting", "to keep child(ren) quiet in public space" and "when the parent is busy doing housework etc." were found to have higher children's smartphone usage frequency. With regard to the rules for children's smartphone usage, households that ensure children to "seek permission of an adult before using a smartphone" or "use a smartphone only when accompanied an adult" were found to have lower children's smartphone usage frequency.