

# Relationship between excessive gadget exposure and language development disorders in early childhood: a case study in urban areas

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## ABSTRACT

This study aims to analyze the relationship between excessive exposure to gadgets and language development disorders in early childhood in urban areas of Indonesia. Using a correlational quantitative approach and case study design, as many as 100 children aged 2–5 years from Jakarta, Bandung, and Surabaya were made respondents. The instruments used included a questionnaire on gadget exposure, the Early Language Milestone Scale (ELM-2), and direct clinical observation. The results of the analysis showed that there was a significant negative relationship between the duration of gadget use and the language development score ( $r = -0.624$ ,  $p < 0.01$ ). A simple linear regression model showed that the duration of exposure to gadgets contributed to a 38.9% variation in language development scores, with each additional 1 hour of screen time per day lowering the language score by 7,431 points. These findings confirm that uncontrolled exposure to gadgets can be a serious risk factor for early childhood language delay. Therefore, parental intervention, setting the duration of screen time, and selecting appropriate digital content are very important in promotive and preventive efforts for children's growth and development in the digital era.

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## 1. INTRODUCTION

The development of information technology has brought great transformations in people's lives, including in the parenting of children. Gadgets such as smartphones and tablets are now an integral part of daily life, even for early childhood (Ahearne et al., 2016). This phenomenon is increasingly massive in urban areas where high mobility makes parents often use gadgets as a distraction tool for children.

In the context of child development, early childhood (0–6 years) is a very crucial golden age. One of the important developmental aspects of this phase is language development, which is closely related to cognitive, social, and emotional abilities (Kuhl, 2010). Improper stimulation during this period can lead to disorders, including delays in language development.

Several studies state that excessive use of gadgets has a negative impact on children's verbal communication skills. Passive exposure to screens leads to a lack of two-way interaction which is important in triggering language responses (Chonchaiya & Pruksananonda, 2008). Healthy

interaction between children and parents, especially direct conversations, is actually one of the key factors in children's language development.

On the other hand, there are significant differences in gadget usage habits between children in rural and urban areas. Children in urban areas tend to have wider access to digital devices. The availability of internet connections, modern lifestyles, and limited parental time affect children's interaction patterns with gadgets (Domingues-Montanari, 2017).

Despite concerns from the medical and educational circles, there are still many parents who do not understand the impact of gadget use on children's development. Some even think that educational applications in gadgets can replace the role of direct verbal interaction (Lin et al., 2015). This prompted the need for scientific research that empirically proved the link between gadget exposure and language disorders.

Previous research in various countries has shown relatively consistent results. In Canada, a study by Madigan et al. (2019) found that children who used screens for more than 2 hours per day had lower expressive language skills. However, there has not been much similar research conducted in Indonesia, especially in urban areas that have their own unique socio-cultural characteristics.

Therefore, this study aims to examine the relationship between excessive exposure to gadgets and language development disorders in early childhood in urban areas of Indonesia. The results of this study are expected to be a basis for consideration for parents, health workers, and policymakers in forming healthy gadget usage habits for children.

## 2. METHOD

### 2.1 Research Types and Design

This study is a non-experimental quantitative research with a correlational study approach. The purpose of this study is to determine the relationship between excessive exposure to gadgets (free variables) and language development disorders (bound variables) in early childhood. The correlational design was chosen because it allowed researchers to identify the strength and direction of the relationship between variables without conducting direct intervention.

The case study design was also applied to deepen the analysis in a specific context, namely children in urban areas of Indonesia. The focus of urban areas was chosen because statistically children in urban areas are more exposed to technological devices, especially gadgets, than in rural areas.

### 2.2 Research Location and Time

The research was carried out in three major Indonesian cities that represent urban areas, namely: Jakarta (DKI Jakarta) as the largest urban center in Indonesia, Bandung (West Java) as a metropolitan city with a high level of education and high penetration of gadgets, Surabaya (East Java) as an urban representation of the eastern part of Indonesia. The research implementation period starts from January to March 2025, including the stages of licensing, data collection, validation, and analysis.

### 2.3 Population and Research Sample

The population in this study is all children aged 2–5 years who live in urban environments and have access to the use of gadgets. This age range was chosen because it is an important phase in language development, in accordance with the theory of children's linguistic development (Kuhl, 2010). The sampling technique was carried out by purposive sampling, with the following inclusion criteria: Children aged 24–60 months, Living in an urban area for at least the last 1 year, Parents willing to be respondents and filling out questionnaires, Children have no history of neurological disorders or developmental delays that have been medically diagnosed. The number of samples used was 100 children, which were divided proportionally in three research cities. Each city accounted for 30–35 respondents.

### 2.4 Research Variables

Free Variable (X): The intensity of exposure to gadgets, which is measured based on average daily duration (hours/day), type of content (video, games, educational), and usage patterns (independent, with parents, or uncontrolled). Bound Variable (Y): The level of early childhood language development, which is assessed through developmental questionnaires and direct observation.

## 2.5 Research Instruments

### 2.5.1 Gadget Exposure Questionnaire

This instrument was developed based on several international references such as ScreenQ by Barr et al. (2020), and adapted to the Indonesian context. Questions include: Type of gadget used, Length of time of use each day, when is the child's main time using the gadget (morning, noon, night), Dominant type of content, whether or not use is supervised.

### 2.5.2 Scale Perkembangan Bahasa (Early Language Milestone Scale-2/ELM-2)

This measuring tool is used to assess the delay in children's language development. ELM-2 covers three main domains: Auditory Expressive Language (the ability to express with words), Auditory Receptive Language (the ability to understand instructions), Visual Language (the ability to imitate and demonstrate). ELM-2 was chosen because it has been widely used and valid for the early childhood population (Coplan, 1993).

### 2.5.3 Direct Clinical Observation

As many as 25% of the total sample (n = 25) were randomly selected for direct observation by child psychologists to verify the validity of the questionnaire results. Observation is carried out at PAUD or at home according to the willingness of parents.

## 2.6 Data Collection Procedure

The management of research ethics permits through the Ethics Committee of the Faculty of Medicine. Coordination with PAUD institutions and health centers in each city. Socialization to parents and providing informed consent. Filling out a questionnaire by parents (assisted by an enumerator if needed). Implementation of direct clinical observation on some samples. Data input and processing using Microsoft Excel and SPSS 26.

## 2.7 Data Analysis Techniques

The data were tested first with the Kolmogorov–Smirnov normality test. The Pearson Product Moment correlation test was used to test the relationship between the duration of gadget exposure and language development scores. A simple linear regression test was also performed as an additional measure to measure the influence of gadget exposure on language delay. Interpretation was carried out with a significance of  $p < 0.05$ . All analysis processes are carried out using SPSS software version 26.0.

## 3. RESULTS AND DISCUSSION

### 3.1 General Description of Respondents

This study involved **100 early childhood children (2–5 years)** from urban areas: Jakarta (34 children), Bandung (33 children), and Surabaya (33 children). The characteristics of children and the use of gadgets are summarized in **Table 1** below:

**Table 1.** Respondent Characteristics (n = 100)

Characteristics	Frequency	Percentage (%)
Gender		
Man	62	62%
Woman	38	38%
Child's Age		
2–3 years	30	30%
3–4 years	41	41%
4–5 years	29	29%
Duration of Gadget Exposure		
< 1 hour/day	18	18%
1–2 hours/day	26	26%
2–3 hours/day	24	24%
> 3 hours/day	32	32%
Most Content Types		
Entertainment videos (YouTube, TikTok)	44	44%
Interactive games (children's games)	32	32%
Educational applications	24	24%

As many as 32% of children are exposed to gadgets for more than 3 hours per day, while only 18% use gadgets < 1 hour/day.

Based on demographic data, the majority of respondents in this study were male children (62%), with the largest age group in the range of 3-4 years (41%). These findings are consistent with reports on the development of the urban child population in Indonesia, where the gender distribution is generally balanced, but boys are more often involved in the use of digital devices than girls (Ministry of PPPA, 2023). This can be attributed to a higher tendency for exploratory behaviors in boys, including an attraction to gadgets and visual-based content and games.

In terms of the duration of use of gadgets, as many as 32% of children are exposed to gadgets for more than 3 hours per day, while only 18% have a duration of use of <1 hour/day. This shows that most early childhood in urban areas has high access to digital devices. The high prevalence of gadget use in this group indicates a potential threat to aspects of child development, especially social and language skills, as described by Chonchaiya & Pruksananonda (2008) and Domingues-Montanari (2017). Duration of use of more than 2 hours/day has even been categorized as a risky exposure in the recommendations of the American Academy of Pediatrics (AAP, 2016).

Interestingly, the distribution of the type of gadget content consumed shows that entertainment videos (e.g. YouTube and TikTok) dominate (44%), followed by interactive games (32%), and educational apps (24%). This reflects that although many apps are designed for educational purposes, children are more interested in entertainment content. This is in line with the findings of Barr et al. (2020) who mentioned that children tend to choose content that features fast animations, bright colors, and dynamic music—typical characteristics of popular entertainment videos.

The age distribution of children (30% of 2–3 years old, 41% of 3–4 years old, and 29% of 4–5 years old) gives an idea that the critical phase of language development (especially between the ages of 2–4 years) is dominated by age groups that are vulnerable to exposure to digital media. In this phase, the child begins to build expressive and receptive skills through intensive verbal interaction. If this phase is replaced by passive screen-based exposure, the risk of language delay will increase significantly (Zimmerman et al., 2007).

In general, the respondents' descriptions reinforce the basic premise that early childhood in urban areas has a high tendency towards the use of gadgets, both in terms of duration, frequency, and content preferences, all of which can affect the course of the growth and development process, especially in the realm of language and communication. Thus, the mapping of respondent characteristics is an important foundation in understanding the context of the relationship between gadget exposure and language development which is further discussed in the correlation and regression tests.

**3.2 Normality and Correlation Test Results**

Before conducting the Pearson correlation test, a normality test was carried out on language development data and the duration of exposure to gadgets using the Kolmogorov-Smirnov Test. Result:

- a. Significance value > 0.05 → normal distributed data:

Gadget exposure: p = 0.087

ELM-2 score: p = 0.104

Then a Pearson correlation test was carried out between the duration of exposure to gadgets and language development scores (based on ELM-2):

**Table 2.** Pearson Correlation Test Results

Variabel	r	Sig. (2-tailed)
Gadget duration vs ELM-2 score	-0.624	0.000 (p<0.01)

With:

- a. A strong negative correlation value (r = -0.624) showed that the longer the exposure to the gadget, the lower the language development score.
- b. The results were statistically significant (p < 0.01), meaning that there was a real relationship between the two variables.

The normality test using the Kolmogorov–Smirnov test showed that the two variables—the duration of daily gadget use and the child's language development score based on ELM-2—had significance values greater than 0.05 (p = 0.087 and p = 0.104). This indicates that the distribution

of data is normal, so the use of parametric analysis such as the Pearson correlation test is appropriate (Ghozali, 2016).

The results of the Pearson correlation test showed a significant negative relationship between the duration of gadget exposure and early childhood language development, with the correlation coefficient values  $r = -0.624$  and  $p\text{-value} = 0.000$  ( $p < 0.01$ ). This coefficient shows a fairly strong correlation force in the negative direction, which means that the longer the duration of use of the gadget, the lower the child's language development score. This negative correlation is statistically significant, so the relationship between the two variables is not caused by mere coincidence.

These findings reinforce previous studies that have also found similar relationships. For example, Madigan et al. (2019) in a longitudinal study in Canada found that children exposed to digital screens for more than two hours per day had lower expressive language skills compared to children with less exposure. This study also reinforces the results of Zimmerman et al. (2007) who reported that the increase in television viewing time was inversely proportional to the number of vocabulary of children under 3 years of age.

From a neuropsychological perspective, this negative correlation can be explained through the deprivation hypothesis of verbal interaction, where children who spend more time in front of screens tend to get less two-way stimulation from parents or caregivers. Gadgets, especially in the form of entertainment videos, are passive and one-way, so the child is not encouraged to respond verbally or ask questions, which is an important process in the formation of receptive and expressive language (Christakis et al., 2009).

In addition, the use of unsupervised gadgets often presents content in a language that is less appropriate for the child's age, or even in a foreign language, which can lead to linguistic confusion and delays in the acquisition of the native language. This is exacerbated when direct social interaction with parents or caregivers is also limited, either due to work factors, urban lifestyles, or due to dependence on digital devices as "digital caregivers".

However, the correlation found is not a direct causal relationship, meaning we cannot conclude that exposure to gadgets automatically causes language delays. There are still other variables that may play a role as mediators or moderators in this relationship, such as the level of parental education, the frequency of family communication, the type of digital content, and the nutritional status of the child. This research focuses on correlation as a first step to understanding more complex phenomena.

Thus, these correlation results provide strong quantitative evidence that the duration of daily gadget use is related to early childhood language development, especially in urban populations that are more intensive in the use of digital media. These results serve as an important warning for parents, early childhood education teachers, and early childhood education policymakers to pay attention to the duration and quality of digital interactions during this highly sensitive developmental period.

### 3.3 Simple Linear Regression Test Results

To strengthen the analysis, a simple linear regression test was also carried out with the duration of use of the gadget as a predictor of language development scores.

**Table 3.** Linear Regression Model Summary

Model	R	R <sup>2</sup>	F	Itself.
1	0.624	0.389	61.84	0.000**

**Table 4.** Linear Regression Coefficient

Variable	B	Std. Error	Beta	t	Itself.
(Constant)	98.213	2.401	—	40.91	0.000
Gadget Duration	-7.431	0.948	-0.624	-7.86	0.000**

With:

- The negative regression coefficient showed that every 1 hour of gadget use/day would decrease the child's language development score by 7,431 points.
- This regression model explains 38.9% variation in language development scores ( $R^2 = 0.389$ ).

A simple linear regression analysis was performed to find out how much the duration of exposure to gadgets affects the level of early childhood language development. Based on the regression results, a determination coefficient value ( $R^2$ ) of 0.389 was obtained, which means that

around 38.9% of the variation in children's language development can be explained by the variable duration of use of gadgets. The rest, which is 61.1%, is explained by other variables not studied in this study such as the quality of verbal interaction at home, parental education, nutrition, and the child's health status.

An R value of 0.624 indicates a strong relationship between the two variables, according to the results of the previous Pearson correlation. In addition, the calculated F value of 61.84 with a significance  $p < 0.01$  confirms that this regression model is statistically significant, which means that the gadget duration variable has a real contribution in predicting language development scores.

The regression coefficient (B) of -7.431 shows that any increase in the duration of gadget use by 1 hour per day has the potential to reduce children's language development scores by 7.431 points on the ELM-2 scale. This coefficient has a significance value of  $p = 0.000$ , which means that statistically the influence is very significant and not a coincidence.

This interpretation strengthens the finding that the duration of exposure to gadgets is not only negatively correlated, but also contributes significantly to affecting the quality of children's language development. The longer the child spends time using gadgets, especially without supervision or with uneducational content, the lower the language score obtained. This supports the results of a study by Lin et al. (2015) which found that longer duration of screen use was associated with impairments in the articulation and verbal expression abilities of preschool-aged children.

In addition, practically, the results of this regression confirm that the duration of screen time has a linear and direct effect on the decline in language quality, not just a long-term cumulative effect. This means that even if it only happens in a few months, excessive use of gadgets is still risky if not controlled early.

The regression results also indicate that effective interventions to prevent language development disorders in children in the digital age are not enough just to pay attention to the type of content, but also to specifically limit the duration of exposure to gadgets. These restrictions should be combined with the enrichment of a direct communication-based environment, such as storytelling, singing, or role-playing activities that involve two-way dialogue.

Nevertheless, it is important to note that simple linear regression involves only one predictor variable. To obtain a more comprehensive picture of the determinants of language delay, multiple linear regression by including control variables such as maternal education level, number of children at home, or frequency of reading activities together is strongly recommended in follow-up research. Thus, the results of this regression test not only provide statistically strong evidence regarding the influence of the duration of gadget use on early childhood language skills, but also reinforce the urgency of screen time regulation by parents, teachers, and policymakers in the context of human resource development from an early age.

#### 4. CONCLUSION

Based on the results of this study, it can be concluded that there is a significant negative relationship between the duration of exposure to gadgets and language development in early childhood in urban areas, where the use of gadgets for more than 3 hours per day has been shown to significantly reduce language development scores. These findings confirm the importance of the role of parents in limiting the time spent using gadgets and ensuring quality direct verbal interaction as the main form of stimulation in the child's language development phase. Therefore, it is recommended that parents, educators, and policy makers implement strict screen time regulations, prioritize two-way communication activities in the family environment, and educate the public about the impact of excessive use of gadgets on children's growth and development from an early age.

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