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The Impact of Gadget Usage Intensity on Language and Speech Development in Preschool Children in Denpasar City

Ni Made Ovilianty Chandra Dewi[1], I Made Niko Winaya[2], Gede Parta Kinandana[3], Luh Putu Ratna Sundari[4]

[1]Bachelor of Physiotherapy Program and Professional Physiotherapy Program, Faculty of Medicine, Udayana University, Denpasar, Bali
[2,3]Department of Physiotherapy, Faculty of Medicine, Udayana University, Denpasar, Bali
[3]Department of Physiology, Faculty of Medicine, Udayana University, Denpasar, Bali
*Correspondence: ovilianti2001@gmail.com

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ABSTRACT

Introduction: The rapid advancement of technology, including the widespread use of gadgets across various age groups, affects even preschool children. Excessive gadget use can reduce opportunities for children to learn and receive stimulation from their environment. Stimulation may help the development of language and speech skills in children. Language and speech development delays can subsequently impact a child's overall development.
Methods: This study employed an observational analytic method with a cross-sectional approach. Subjects were selected using purposive sampling. The intensity of gadget usage was measured through questionnaires filled out by the subjects' parents, while language and speech development were assessed using the Denver II test.
Results: The study included 108 subjects. Non-parametric Spearman's rho analysis revealed a p-value of 0.000 ($p < 0.05$) and a correlation coefficient (r) of 0.394.
Conclusion: The results of this study indicate a relationship between the intensity of gadget usage and the language and speech development of preschool children in Denpasar City.

Keywords: intensity, gadgets, language, speech, children

INTRODUCTION

The preschool period is a critical phase in a child's development, often called the "golden age." Children experience rapid growth and development across various domains during this stage, making it an essential time for fostering foundational skills and abilities.[1] Preschool children between the ages of 3 and 6 exhibit an increased sense of responsibility in their daily activities. During this period, they are better prepared and more ready to build and establish relationships with their external environment.[2] According to the Indonesian Pediatric Association, in 2013, approximately 5 to 10% of children were estimated to experience developmental delays in areas such as gross motor skills, fine motor skills, language and speech, and personal-social abilities. Verbal or language delays are among the most common developmental issues young children in Indonesia face. The Ministry of Health reported in 2015 that around 8% of children experienced language and speech development delays.[3] The prevalence of language and speech development delays in school-age children in Indonesia is estimated to be around 5% to 10%.[4] Meanwhile, the incidence of language development disorders in the general population ranges from 1% to 32%. Several factors influence this variation, including differing diagnostic criteria, the age at diagnosis, differences in data collection methodologies, and other factors.[5]

A study by Rismawan in 2018 on screening general developmental delays in early childhood education (PAUD) children in Denpasar City found that, out of a total of 15 subjects with developmental delays, all exhibited delays in verbal development or language skills.[6] The prevalence of language and speech delay rates in the research conducted at RSUP Sanglah Denpasar among subjects aged 2-4.5 years is approximately 5-8%, while among children aged 25-36 months, it is around 55.1%.[7] Children with developmental delays in language and speech are described as individuals who require a longer time to reach developmental milestones than children of the same age.[8]

In this era, various telecommunication devices, including tablets, laptops, smartphones, and netbooks, are rapidly evolving and widely used by most people to fulfil their daily needs.[9] Human life is inseparable from the use of gadget devices across all age groups, including children. At a very early age, children born in the era of technological and informational advancement are already familiar with the internet and various technological advancements. According to data from the Central Statistics Agency in 2020, 29% of all gadget users are children in the early age range. There are 26.52% of toddlers using mobile phones, and 14.64% of toddlers using the internet.[10]

The use of gadgets by children in the early age category can have positive and negative impacts. Generally, gadgets can stimulate or enhance children's auditory and visual senses, improve verbal and communication skills, and

stimulate motor skills development. However, negative impacts include dry eyes due to prolonged gadget use, increased passivity or reduced physical activity, and diminished social interaction, as gadget usage tends to be more individual-focused.[11] Many children become dependent on gadget usage. This situation is still perceived as usual by parents because they believe that everything is made easier with gadgets in this digital era.[12]

Fajariyah's 2018 research found that among children with high gadget usage intensity, the majority, around 75%, showed results indicating doubtful development. This is because excessive gadget usage can lead to various developmental disturbances in children, such as verbal and emotional development disorders and cognitive impairments. Excessive gadget use can eliminate a child's opportunity to process and receive external stimulation. The lack of stimulation can result in suboptimal child development, including speech and language development delays. These delays can affect the child's future growth, making learning difficult or leading to learning disabilities.[13]

Language and speech skills are vulnerable to conditions of delay or anomalies in other systems, such as cognitive, psychological, sensorimotor, emotional, and social aspects in children. Language and speech abilities are crucial as they indicate all other child development abilities.[5] Language and speech development plays a vital role in cognitive development in children because language serves as a tool for thinking, self-expression, and communication. Children with good language skills find it easier to understand acquired information and solve problems, thus influencing their cognitive development.[14] The significance of language and speech development, coupled with the increasing use of gadgets among preschool children, serves as the background for conducting this research. This study investigates the relationship between gadget usage intensity and language and speech development among preschool children in Denpasar City.

The researcher believes that the intensity of gadget usage plays a significant role in a child's language and speech development process. High gadget usage intensity may deprive a child of opportunities to receive external stimuli. Gadget usage often facilitates one-way communication, making the child a passive listener. This lack of stimulation can lead to suboptimal development, including language and speech skills.

Previous research on gadget usage and its impact on language and speech development has been conducted in Jakarta. However, these studies had some limitations, such as using chi-square tests, which cannot determine the direction and strength of the relationship between variables and not control for the age of the subjects. Therefore, this topic is being addressed to complement previous research efforts. The background outlined above serves as the basis for further analysis regarding the relationship between gadget intensity and language and speech development among preschool children aged 3-4 years in Denpasar City. This research aims to provide evidence-based information for readers, especially parents, communities, and healthcare professionals.

METHOD

This research was designed using an analytical observational approach with a cross-sectional design. The study was conducted at toddler-integrated health posts (Posyandu) located in villages or urban areas in each district of Denpasar City, Bali Province, namely Kesiman Kertalangu Village (East Denpasar), Tonja Urban Village (North Denpasar), Sanur Kauh Village (South Denpasar), and Pemecutan Urban Village (West Denpasar), from April to November 2023. The study population consisted of preschool children at the village or urban health posts in Denpasar City selected using purposive sampling techniques.

The Lemeshow formula was used to calculate the subjects in this study. The total number of research subjects was 108 children. Inclusion criteria for subjects involved preschool children aged 3-4 years who were gadget users, willing to participate in this study, and whose parents or caregivers filled out informed consent forms. Exclusion criteria included children with congenital disabilities or genetic abnormalities, uncooperative children, and children with specific medical histories that could affect language and speech development, such as hearing impairment identified through a Hearing Ability Test. Subject selection based on inclusion and exclusion criteria was conducted through anamnesis or interviews with the subjects' parents. Additionally, a Hearing Ability Test was conducted on subjects to detect hearing impairments in children at an early stage. The Hearing Ability Test is one of the early detection screening instruments for developmental deviations in children, by the Indonesian Ministry of Health.

Dropout in this study occurred when subjects withdrew for various reasons or were absent during data collection. The independent variable in the study was gadget usage intensity, the dependent variable was language and speech development, and the control variable was age.

The instrument used was a gadget usage questionnaire from previous research conducted by Nurmasari (2016), which had been tested for validity and reliability. This gadget usage intensity questionnaire divided gadget usage intensity into three categories: low category range with a duration of 1-30 minutes/day and a frequency of 1-3 days/week, medium category range with a duration of 31-60 minutes/day and a frequency of 4-6 days/week, and high category range with a duration of >60 minutes/day and a frequency of every day. The subjects' parents filled out this gadget intensity questionnaire. Meanwhile, physiotherapists measured language and speech development using the Denver II assessment tool with the assistance of the research group, then interpreted by physiotherapists as usual, suspect, or untestable results.

The subjects in this study were 3-4 years old (calculated if they had completed their third year and had yet to reach their fifth year). Each subject's parents were informed about informed consent and the research overview before the study. After completing the informed consent process, anamnesis and Hearing Ability Tests were conducted, along with the measurement of dependent and independent variables in subjects who met the inclusion and exclusion criteria.

Statistical analysis used in this study included univariate and bivariate analyses. Univariate analysis was conducted to provide a general overview of age, gender, gadget usage, and language and speech development. Bivariate analysis in this study used Spearman's rho correlation test. The collected data were analysed using SPSS 26.0 software. This research has obtained approval from the Research Ethics Committee of the Faculty of Medicine,

Udayana University/Sanglah General Hospital Denpasar, with reference number 442/UN14.2.2.VII.14/LT/2023 and ethical clearance number 387/UN14.2.2.VII.14/LT/2023.

RESULTS

Based on the inclusion, exclusion, and dropout criteria, a total of 108 subjects were obtained. The distribution of subjects was as follows: 29 children in Kesiman Kertalangu Village (East Denpasar), 26 children in Tonja Urban Village (North Denpasar), 25 children in Sanur Kauh Village (South Denpasar), and 28 children in Pemecutan Urban Village (West Denpasar). The subject selection process can be seen in Figure 1.

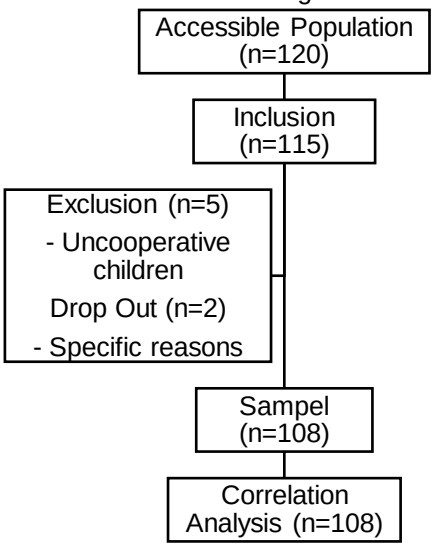

Figure 1. Research Sampling Stage Diagram

Univariate analysis aims to describe the characteristics of subjects based on age, gender, gadget usage, and language and speech development, as seen in Table 1.

Table 1. Frequency Distribution of Subject Characteristics

Variables	Frequency	Percentage
Age (years old)		
3	100	92.6
4	8	7.4
Gender		
Female	59	54.6
Male	49	45.4
Gadget Usage Intensity		
Low	11	10.2
Moderate	46	42.6
High	51	47.2
Language and Speech Development		
Normal	74	68.5
Suspect	25	23.1
Untestable	9	8.3
Parent's Education Level		
Elementary School (SD)	1	0.9
Junior High School (SMP)	11	10.2
Senior High School/Vocational School (SMA/SMK)	45	41.7
Higher Education (College/University)	51	47.2
Parent's Occupation		
Homemaker (IRT)	37	34.3
Civil Servant (PNS)	8	7.4
Private Sector Employee	50	46.3
Entrepreneur	10	9.3
Other	3	2.8

Based on Table 1, it can be seen that the age range of children according to the inclusion criteria is 3-4 years. The dominant number of subjects are aged three years, totalling 100 individuals (92.6%), while those aged four years amount to 8 individuals (7.4%). Female subjects in the study are 59 individuals (54.6%), while male subjects are 49 individuals (45.4%). Out of the total 108 subjects, there are 51 individuals (47.2%) showing high-intensity gadget usage, 46 individuals (42.6%) showing moderate-intensity gadget usage, and 11 individuals (10.2%) showing low-intensity gadget usage. There are 74 individuals (68.5%) with everyday language and speech development, 25 individuals (23.1%) with suspected language and speech development, and nine individuals (8.3%) with untestable language and speech development.

Regarding the characteristics of the subjects' parents based on education level, there is one individual (0.9%) with primary education (SD), 11 individuals (10.2%) with junior high school education (SMP), 45 individuals (41.7%) with high school education (SMA/SMK), and 51 individuals (47.2%) with tertiary education (college/university). Based on their occupation, there are 37 individuals (34.3%) who are homemakers (IRT), eight individuals (7.4%) working as civil servants (PNS), 50 individuals (46.3%) working in private sector, 10 individuals (9.3%) working as entrepreneurs, and three individuals (2.8%) have other occupations.

Bivariate analysis determined the relationship between gadget usage intensity and language and speech development. Cross-tabulation results and analytical tests can be seen in Tables 2 and 3.

Table 2. Cross-tabulation of Gadget Usage Intensity with Language and Speech Development

Gadget Usage Intensity	Language and Speech Development						Total		P Value
	Normal		Suspect		Untestable				
	n	%	n	%	n	%	N	%	
Low	8	7.4	0	0	3	2.8	11	10.2	0.000
Moderate	44	40.7	0	0	2	1.9	46	42.6	
High	22	20.4	25	23.1	4	3.7	51	47.2	
Total	74	68.5	25	23.1	9	8.3	108	100	

Based on Table 2, the majority of subjects, totalling 51 individuals (47.2%), fall into the high gadget usage intensity category, with 22 individuals (20.4%) showing everyday language and speech development, 25 individuals (23.1%) showing suspected language and speech development, and four individuals (3.7%) showing untestable language and speech development.

Table 3. Relationship between Gadget Usage Intensity and Language and Speech Development

Correlation between Variables	Correlation	p Value
Gadget Usage Intensity and Language and Speech Development	0,394	0

Table 3. shows a significant relationship between gadget usage intensity and language and speech development in preschool children in Denpasar City, as evidenced by a p-value of 0.000 ($p < 0.05$) and a correlation coefficient of 0.394, which is positive. This positive value indicates a positive correlation with a moderate correlation because the value falls between 0.25-0.50.

DISCUSSION

The study subjects were aged 3-4 years, with the majority being three years old, totalling 100 children (92.6%). The first three years of a child's life are the most crucial determinant for intelligence formation compared to subsequent phases. A child's growth and development potential will be maximized when provided with good stimulation. During this vital period, particularly in the preschool stage, children require comprehensive and quality guidance and supervision for their overall development.[15] Out of the total study subjects, there were 59 female children (54.6%) and 49 male (45.4%). Yulianda's 2019 study explains that the verbal or language development of male children tends to be slower compared to female children. This is due to the high levels of testosterone during the prenatal phase, which can slow down the growth process of neurons in the brain's left hemisphere, resulting in slower development in aspects such as vocabulary acquisition and language mastery.[16]

The results of this study show that children with high-intensity gadget usage amounted to 51 individuals (47.2%), and moderate-intensity gadget usage involved 46 individuals (42.6%). In comparison, subjects with low-intensity gadget usage were 11 individuals (10.2%). In terms of language and speech development assessment, there were 74 children (68.5%) with everyday language and speech development, 25 children (23.1%) with suspected language and speech development, and nine children (8.3%) with untestable language and speech development.

Based on the research findings, the intensity of gadget usage among preschool children in Denpasar City varied. The range of gadget usage intensity values in terms of duration ranged from the lowest of 10 minutes/day to the highest of 300 minutes/day, equivalent to 5 hours per day, with an average duration of gadget usage of 85.88 minutes/day. The frequency of gadget usage ranged from a minimum of 1 day/week to a maximum of every day, with an average frequency of 5-6 days per week. Furthermore, the age at which children first started using gadgets ranged from 11 months to 38 months, with an average age of first gadget usage being 26.13 months. Most subjects used smartphones, and the main application was for watching videos. Most subjects were supervised by parents or caregivers while using gadgets, as most parents understood the impact of gadget usage on toddlers. During gadget use, subjects predominantly reacted to not turning away when called and not responding when spoken to.

In addition to age, gender, gadget usage, and language and speech development, the characteristics of the subjects were also observed based on their parents' education level and occupation. The research findings indicate that most of the subjects' parents had a tertiary education level, totalling 51 individuals (47.2%), followed by high school/vocational school education level with 45 individuals (41.7%). Through higher education, parents can acquire more knowledge, enabling them to understand the strategies to be applied in educating their children. Dewi's study in 2023 showed a significant relationship between parents' education level and speech delay, indicating that the higher the parents' education level, the better the child's language development.

Regarding the characteristics of the subjects based on their parents' occupation, the majority of the subjects' parents, 50 individuals (46.3%), worked in the private sector. Busy working parents can result in reduced time spent with their children, which can impact the growth and development of the child.[17]

Intensity of Gadget Usage and Its Impact on Language and Speech Development in Preschool Children

Based on the results of non-parametric Spearman rho statistical analysis, a p-value of 0.000 ($p < 0.05$) and a correlation coefficient of 0.394 was found. This indicates a significant relationship with a moderate correlation and a direct correlation between gadget usage intensity and language and speech development in preschool children in Denpasar City. It suggests that the higher the intensity of gadget usage, the higher the likelihood of children experiencing language and speech development delays.

Its duration and frequency of use measure gadget usage intensity. According to the American Academy of Pediatrics (AAP), recommendations for gadget use or screen time for children include no gadget use at all for children aged 18 to 24 months, except for video chatting, and one hour or less per day for children aged 2 to 5 years. The intensity of gadget usage impacts children's language and speech development. Research by Ramelan et al. in 2019 showed that the speech proficiency of young children who use gadgets falls underdeveloped and is beginning to develop. This is because children spend too much time on gadgets and do not socialize with others, resulting in their speech abilities needing to be honed.[18]

This study's statement aligns with findings in West Jakarta involving 100 toddler subjects, with research results indicating a correlation between gadget usage and occurrences of speech and language delays in toddlers.[19] Anggrasari found that 21 children experienced delays in language development among children aged 3-5.[20] Another study in 2023 regarding the effect of digital device exposure time on child development, involving 419 subjects aged 24-36 months, also supports these research findings. Subjects with digital device exposure exceeding 2 hours were significantly associated with decreased receptive and expressive language scores.[21] Aziz and his colleagues' research reveals that children with high screen exposure levels are more commonly reported to have language and speech development delays than other children. This is because speech development typically occurs through interactions with parents and family and face-to-face communication rather than in the digital or two-dimensional world, which doesn't allow children to learn.[22]

Similar results were obtained from another study in 2021 regarding the influence of electronic media or gadgets such as mobile phones, computers, tablets, and others on speech and language delays in children. Language development was measured using the Language Evaluation Scale Trivandrum (LEST). After analysis using MedCalc, the results with a $p<0.05$ indicated a significant relationship. Speech and language delays were observed in 28.4% of children who used electronic media for more than 3 hours.[23] Dewi's research results in 2023 on the relationship between screen exposure and child speech delays also align with this. The Caput Scales were utilized to measure child speech development. The Chi-Square test results indicate that screen exposure for more than two hours per day correlates significantly with speech delays.[24]

The mechanism of language ability in individuals is associated with the brain's left hemisphere.[5] When information is obtained from the visual sense organ, the eyes are relayed from the primary visual cortex to the angular gyrus. Meanwhile, information captured by the auditory sense organ, the ears, is relayed from the primary auditory cortex to the angular gyrus. Subsequently, the information is forwarded to Wernicke's area, where a process of language formulation and selection of words occurs, known as the language formulation process. Then, the result is transmitted to the Broca's area via the arcuate fasciculus and transformed into a programmed sound. The primary motor cortex will then send this sound shape to the tongue and facial muscles, enabling an individual to speak.[25]

Two sensory stimuli play a crucial role in the development of a child's language and speech sector: stimuli from the sense of sight and stimuli from the sense of hearing. This implies that their environment highly influences a child's speaking ability. Children must actively participate in listening to and observing every conversation around them; then, they can begin expressing their ideas or desires by voicing their opinions to others.[5] Interacting and communicating with people in their surroundings is indeed one of the strategies to stimulate language and speech processes in children. Communication with others enhances a child's vocabulary, thereby maximising development in this aspect.[26] Children who use gadgets may become passive listeners and communicate less with others around them. High gadget usage intensity can result in the child's brain receiving stimulation solely from gadgets without any feedback or interaction, impacting the child's language and speech development.[27] Therefore, adults such as parents or family members play a crucial role in monitoring, limiting, and directing children's gadget usage, both in intensity and the applications or media used. A study by Aulia in 2021 stated that the use of gadgets by young children can have positive developmental impacts if the intensity of gadget usage is not excessive and is supervised by parents.[28]

Based on these studies, the intensity of gadget use has a significant relationship with preschool children's developmental process in the language and speech sector. Children tend to become passive listeners when using gadgets frequently and for extended periods. This is because while using gadgets, children only receive stimulation or input from the device, such as exposure to new vocabulary, without any feedback or output through communication and interaction. Additionally, high-intensity gadgets can replace direct interaction or face-to-face communication between children and their parents, caregivers, or others around them. Children categorized as high-intensity gadget users tend to miss opportunities to enhance their language and speech development through direct interactions or activities with their social environment.

Language and speech learning stages involve two main processes: receiving (input) and producing (output). Therefore, prolonged high-intensity gadget use in children can lead to passivity or a lack of learning opportunities, increasing the likelihood of language and speech delays.

However, this research has limitations and shortcomings. The measurement of gadget use variables is solely based on questionnaire results filled out by the subjects' parents, making it subjective and susceptible to bias depending on respondents' perceptions and interpretations of the questions. Additionally, some respondents may need more time to be willing or able to provide complete or honest answers, which can affect the research results. Another limitation is the lack of control over the stimulation and nutritional status of the subjects. Future researchers in similar topics should control these factors to reduce bias. Additionally, they could consider using more comprehensive research designs, such as longitudinal or experimental designs, to provide better and deeper insights into the impact of gadget use on language and speech development in children.

Despite these limitations, the findings of this research still contribute significantly to understanding the correlation between the intensity of gadget use and language and speech development. The practical implication of this research is to improve understanding of the importance of limiting gadget use to optimise language and speech development in preschool children. Furthermore, the findings have broader relevance and applicability, even though the research results are from preschool children in a specific region. The negative impact of gadget use on language and speech development can serve as a reference for interventions or prevention strategies in early childhood populations in various areas. However, other factors must be considered, such as cultural differences and environments that may affect gadget use in different populations. Further research considering cultural and environmental factors, along with more robust and representative designs, can enhance the generalizability of the research findings.

CONCLUSION

The results of statistical analysis and discussions presented indicate a significant relationship between gadget usage intensity and the development of language and speech abilities among preschool children in Denpasar, with a sufficiently high correlation and a positive correlation. These findings can serve as valuable knowledge for parents, healthcare professionals, and the community to pay more attention to using gadgets in young children to ensure optimal language and speech development.

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