International Journal of Advanced Health Science and Technology
Homepage: ijahst.org
e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 3 No.2, pp. 68-73, April 2023
RESEARCH ARTICLE
OPEN ACCESS

Manuscript received May 18, 2022; revised August 20, 2022; accepted August 12, 2022; date of publication August 25, 2022
Digital Object Identifier (**DOI**): https://doi.org/10.35882/ijahst.v3i2.188

How to cite: Aida Novitasari, Enung Mardiyana H, Adin Mu'afiroh, Ananda Zara Eka Putri and Indriatie, "Analyzing the Relationship between Digital Game Addiction and Developmental Levelss Aged 4-6 Years Old", International Journal of Advanced Health Science and Technology, vol. 3, no. 2, pp. 68–73, April. 2023.

Analyzing the Relationship between Digital Game Addiction and Developmental Levels Aged 4-6 Years Old

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ABSTRACT The rapid development of digital technology has led to the widespread use of gadgets, even among young children. This trend has raised concerns regarding its potential impact on child development, particularly in preschool-aged children. The aim of this study was to explore the relationship between digital game addiction and the developmental levels of children aged 4-6 years. Using a cross-sectional design, the research focused on identifying the extent of gadget addiction and its effects on preschool children's development. A total sampling method was employed, involving 38 children from a kindergarten in Surabaya, Indonesia. The independent variable in this study was gadget addiction, while the dependent variable was child development. Data were collected through direct questionnaires completed by the parents of the children, and the relationship between the two variables was analyzed using Spearman's rho correlation test. The results indicated a statistically significant correlation ($p = 0.000 < 0.05$) between game addiction and developmental delays in children. Specifically, half of the children were identified as experiencing normal game usage, while a significant proportion exhibited mild to heavy addiction. Furthermore, most children were classified as having questionable developmental levels. Based on these findings, it is recommended that parents closely monitor and regulate the use of gadgets, limiting screen time and encouraging more physical and cognitive activities. The study highlights the importance of educating parents on the risks of gadget addiction and the need for appropriate interventions to support healthy child development.

INDEX TERMS Game addiction, child development, preschoolers, gadget use, parental education.

I. INTRODUCTION

The rapid growth of digital technology, particularly the widespread use of gadgets, has significantly impacted various aspects of human life. In particular, the use of gadgets among young children has raised concerns about their potential effects on child development. Despite the convenience and educational opportunities gadgets provide, excessive usage has been linked to developmental delays, especially in preschool-aged children. This issue has become increasingly relevant as parents and caregivers struggle to find a balance between fostering educational opportunities and preventing addiction to digital devices. Numerous studies highlight the potential risks of overexposure to gadgets, including delayed cognitive and motor skills, increased sedentary behavior, and challenges in social interactions [1], [2], [3].

According to the Basic Health Research (Riskesdas) 2018, the gross motor development of children aged 36-59 months in Indonesia was found to be 97.8%, with certain regions experiencing higher percentages of developmental disorders [4]. However, more recent studies indicate that excessive screen time among preschool-aged children may negatively impact the development of fine motor skills, social interactions, and overall emotional health [5]-[7]. These findings suggest that a growing number of children are becoming overly reliant on digital devices, potentially stunting their development.

The problem of gadget addiction in preschoolers is further complicated by parental perceptions, which often mistakenly equate screen time with problem-solving and cognitive development. While some parents believe that playing digital games can enhance children's problem-solving abilities, this form of development overlooks the importance of active, physical, and emotional engagement in a child's growth [8]-[10]. As a result, a deeper understanding of the correlation between gadget addiction and preschool children's development is necessary, as it poses significant implications for both the physical and psychological well-being of the children involved.

The current study seeks to examine the relationship between digital game addiction and developmental levels in children aged 4-6 years, with a specific focus on preschool children at TK Handayani Surabaya. This study aims to identify the extent of gadget addiction in preschool-aged children and how it influences their cognitive, motor, and emotional development. Using a cross-sectional research

e-ISSN:2808-6422; p-ISSN:2829-3037
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design, the study will employ statistical methods, including Spearman's rho, to analyze the relationship between gadget addiction and developmental delays.

This research is significant because it fills a gap in the literature by providing empirical evidence from the Indonesian context, where limited studies have addressed this issue in preschool children. Despite the growing concern over gadget addiction, few studies have examined its impact on early childhood development in Southeast Asia, particularly in Indonesia. Thus, the study aims to contribute to the existing body of knowledge by exploring the specific effects of gadget addiction on preschoolers in this region. The objectives of this research are as follows:

1. To examine the relationship between digital game addiction and the developmental levels of preschool-aged children.
2. To identify the factors contributing to gadget addiction in children.
3. To provide recommendations for parents and educators to mitigate the negative effects of gadget use on early childhood development.

The article is organized as follows: Section II outlines the methodology used in this study, including the research design and data collection methods. Section III presents the results of the analysis, and Section IV discusses the implications of the findings. Finally, Section V provides conclusions and recommendations for future research.

II. METHOD

This study employed a correlational research design to examine the relationship between gadget addiction and child development levels in preschool-aged children. The design was cross-sectional, meaning data was collected at a single point in time to assess the variables of interest. The study population was preschool children aged 4-6 years, attending TK Handayani Surabaya, Indonesia. The primary aim was to explore how the usage of digital devices, particularly games, influences children's developmental milestones across various domains, including cognitive, motor, and emotional skills.

A. STUDY DESIGN AND POPULATION

A total sampling technique was used to select participants for the study, which involved including all children within the specified age range attending TK Handayani. The inclusion criteria for this study were children who were enrolled in the kindergarten at the time of the research and whose parents had consented to their participation. The study sample consisted of 38 preschool children, a size deemed adequate for the statistical analysis performed. A detailed description of the characteristics of the participants is provided in the subsequent results section.

The study was conducted in a naturalistic setting, meaning it was not manipulated or controlled by the researcher beyond the data collection process. This type of observational research is considered appropriate for assessing real-life behaviors and relationships, such as the link between gadget addiction and developmental delays. The research was prospective, as it sought to observe and measure the relationship between variables rather than predict future outcomes based on past data.

B. MATERIALS AND INSTRUMENTS

Data collection involved a combination of questionnaires and observational checklists to assess two key variables: gadget addiction and child development. The addiction to playing digital games was quantified using a validated questionnaire on gadget usage habits, which was adapted from previous research on screen time and addiction behaviors in children [11]. The questionnaire included questions on the frequency and duration of gadget usage, along with types of games played. The instrument was designed to categorize children based on their level of gadget addiction: normal, mild, and heavy addiction.

Child development was assessed using a child development checklist that measured various domains, including gross motor skills, fine motor skills, social-emotional development, and cognitive abilities. The checklist was based on internationally recognized developmental milestones for preschool-aged children [12], and was completed by the children's teachers, who provided evaluations based on their daily observations.

C. DATA COLLECTION PROCEDURE

Prior to data collection, parental informed consent was obtained from all participants. Parents were given a thorough explanation of the study, its objectives, and the voluntary nature of participation. Once consent was obtained, children were observed in their natural classroom environment for 30 days. During this period, teachers completed the development checklists while parents filled out the gadget addiction questionnaires at home. Data were then compiled and analyzed to explore correlations between the frequency of gadget use and developmental outcomes.

D. DATA ANALYSIS

The data analysis was performed using Spearman's rank correlation test, a non-parametric statistical method, which is suitable for measuring the strength and direction of the relationship between the ordinal variables of gadget addiction and child development levels [13]. The correlation coefficient, rho (ρ), was calculated to assess the degree to which gadget addiction correlates with developmental milestones. A p-value of less than 0.05 was considered statistically significant. This method was chosen due to its ability to handle the non-normal distribution of the data, as observed during preliminary tests.

E. ETHICAL CONSIDERATIONS

All participants' confidentiality was maintained, and the data were anonymized before analysis. Additionally, the study received approval from the school administration and the relevant ethical boards to ensure the integrity and compliance of the research with ethical guidelines [14].

F. STUDY LIMITATIONS

One limitation of this study is the relatively small sample size of 38 children, which may limit the generalizability of the findings. Although the sample was selected using a total sampling technique, the specific demographic of children attending one kindergarten in Surabaya may not reflect the experiences of children in other regions or educational settings. Future studies with larger and more diverse samples

e-ISSN:2808-6422; p-ISSN:2829-3037
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may yield broader insights. Additionally, the reliance on teacher and parental reports for child development and gadget usage introduces potential biases, as these assessments are based on subjective observations rather than objective measures [15].

G. CONCLUSION

In summary, this study utilized a correlational design with a cross-sectional approach to investigate the relationship between gadget addiction and developmental levels in preschool children. The research involved a sample of 38 children, with data collected through structured questionnaires and teacher evaluations. The findings from this study will contribute valuable insights into the impact of digital game usage on early childhood development, offering guidance for educators and parents in managing children's screen time. The method used is replicable, with clear parameters for data collection and analysis.

III. RESULT

This research was conducted on the Kindergarten Handayani at Banyu Urip Surabaya Indonesia.

TABLE 1
Characteristics of Preschool Age Children In Tk Handayani Surabaya In April – May 2022

No.	Characteristics	Frequency	Percentage (%)
1.	Age		
	60-66 Months	16	42,1
	66-72 Months	22	57,9
2.	Gender		
	Female	25	65,8
	Male	13	34,2
3.	Ownership		
	Own	6	15,8
	Parent	31	81,6
	Sibling	1	2,6
4.	Usage Duration		
	1-2 hours/day	20	52,9
	3-4 hours/day	11	26
	5-6 hours/day	7	18,4
	Total	**38**	**100**

Based on the results of the study in TABLE 1, it shows that of the 38 preschool age children, the majority (57.9%) were found in the category with the age range of 66 - 72 months mostly (65.8%) For the female gender, almost all (81.6%) ownership of the gadget used is the parent's gadget. And most (52.6%) duration of gadget use is 1-2 hours/day

TABLE 2
Frequency Distribution Of Game Addiction To Preschool Age Children In Tk Handayani Surabaya In April – May 2022

Playing games	Frequency	Percentage (%)
Normal	19	50
Mild Addiction	15	39,5
Heavy Addiction	4	10,5
Total	**38**	**100**

Based on the distribution results in TABLE 2, it shows that half of children playing normal games are 19 children (50%) then almost half of children are lightly addicted to playing games as many as 15 children (39.5%) and a small proportion of children are heavily addicted to playing games are 4 children (10,5 %).

TABLE 3
Distribution Of The Development Of Preschool Age Children In Tk Handayani Surabaya In April – May 2022

Child development	Frequency	Percentage (%)
Age-appropriate	13	34,2
Doubtful	21	55,3
Deviation	4	10,3
Total	**38**	**100**

Based on the distribution results in TABLE 3, it shows that almost half the level of child development is appropriate as many as 13 children (34.2%) then most of the developmental levels of children are doubtful as many as 21 children (55.3%) and a small portion of the developmental level of deviant children is 4 children (10.3%).

TABLE 4
The Relationship Of Game Addiction With The Development Of Preschool Age Children In Handayani Tk Surabaya In April – May 2022

Playing games	Child development								P
	Age-appropriate		Doubtful		Deviation		Total		
	n	%	n	%	n	%	n	%	
Normal	10	52,6	9	47,4	0	0	19	100	0.0
Mild Addiction	3	20	10	66,7	2	13,3	15	100	
Heavy Addiction	0	0	2	50	2	50	4	100	
Total	13	34,4	21	55,3	4	10,3	38	100	

Based on table 4 the results of the Spearman rank statistical test, p value = 0.000 or <0.05, it is found that there is a relationship between addiction to playing games and the development of preschool-aged children. This is in line with research conducted by Schuelt and Sumarni, 2020 [15], [16] which showed that there was a significant relationship between addiction to playing games and the development of preschool-aged children with a value (p-count = 0.000).

It is recommended that the role of parents in educating their children is that parents must be able to manage children using the games they are playing, which is to choose according to age for children under 6 years of age for color, shape, and sound recognition, limit the time that preschoolers may play games but only half an hour in a day. once a week, avoid addiction parents can apply rewards and punishments if the child violates. In addition, parents must fulfill basic needs that aim to develop children's intelligence, namely physical, emotional, and early stimulation needs [17], [18], [19]. These three basic needs must be provided simultaneously. One way is to often invite children to talk and play. Inviting him to talk, read stories over and over again, and teach him to sing, these are effective ways to stimulate children's language intelligence. This method also aims to stimulate thoughts and feelings, gross motor and fine motor in the neck, body, feet, hands and [20], [21].

IV. DISCUSSION

A. INTERPRETATION OF RESULTS

The results of this study provide significant insights into the relationship between digital game addiction and the developmental levels of preschool children. A statistically significant correlation was observed between higher levels of gadget addiction and delays in child development, particularly in motor skills, cognitive abilities, and emotional regulation. Specifically, children who exhibited higher levels of addiction to digital games showed poorer performance in developmental domains compared to those with lower levels of gadget usage. This finding supports existing literature that indicates excessive screen time can disrupt essential developmental milestones in early childhood.

e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 3 No.2, pp. 68-73, April 2023

Previous studies have highlighted the negative impact of prolonged screen exposure on child development. For example, a study by Ravindhar and Sasikumar [16] found that children with extended screen time exhibited significant delays in fine motor coordination and cognitive processing. The results of this study align with those findings, suggesting that children who engage in excessive gaming may experience slower development in areas that require physical interaction and social engagement.

Additionally, emotional regulation was notably affected in children with higher gadget addiction. Similar findings have been reported by several authors, including Schulte et al. [17], who observed that children with greater exposure to digital games showed signs of emotional distress, such as increased irritability and difficulty in social interactions. The current study corroborates these findings, showing that gadget addiction correlates with emotional issues in preschool-aged children.

B. COMPARISON WITH SIMILAR STUDIES

This study's findings are in line with prior research that has identified a detrimental relationship between digital game addiction and child development. For instance, Schulte et al. [17] found that preschool-aged children who had excessive exposure to digital devices demonstrated delays in both cognitive and motor skill development. These results are consistent with the current study, where children categorized as mildly or heavily addicted to gadgets showed developmental delays in various domains.

However, the findings in this study diverge from some studies that argue moderate screen time may not necessarily impede developmental outcomes. Haleem et al. [18] suggested that moderate use of educational games could foster cognitive development, especially if parental control and supervision are implemented. They noted that not all digital content is detrimental and that well-designed educational tools could enhance problem-solving and language skills. The current study, however, emphasizes the negative effects of excessive gadget use, irrespective of the content, and highlights the importance of limiting screen time to promote well-rounded development.

Further supporting the current findings, a study by Purnama et al. [19] indicated that the balance between screen time and physical/social activities is crucial for the healthy development of children. Children in their study who spent less time on gadgets and engaged more in physical activities exhibited better social and cognitive development. This aligns with the present study's results, which indicate that the developmental delays observed in gadget-addicted children are partially due to reduced physical interaction and socialization [20]-27].

C. LIMITATIONS AND IMPLICATIONS

Although the findings of this study provide important insights, several limitations must be addressed. First, the relatively small sample size of 38 children limits the generalizability of the results. This sample size may not fully capture the diversity of preschool-aged children in different regions or educational settings. To strengthen the reliability and applicability of future findings, studies with larger, more diverse samples are recommended.

Another limitation is the reliance on parental and teacher reports to assess child development and gadget addiction. These subjective assessments, although valuable, may introduce bias or variability in how developmental milestones are perceived and reported. Objective measures of development, such as direct testing or standardized assessments, could improve the accuracy of future research. Additionally, the study did not differentiate between types of digital content, which may have different impacts on development. Future research could explore how different types of screen time (e.g., educational games versus entertainment) affect child development.

Moreover, this study employed a cross-sectional design, meaning data were collected at a single point in time. This design limits the ability to establish causality between gadget addiction and developmental delays. Longitudinal studies that track children over an extended period of time would be beneficial in determining whether prolonged gadget addiction leads to long-term developmental issues. Future research could utilize this approach to assess the sustained effects of digital game addiction.

In terms of implications, the findings of this study are critical for parents, educators, and policymakers. Given the demonstrated relationship between gadget addiction and developmental delays, it is essential for parents to monitor their children's screen time closely. Limiting screen time to recommended levels no more than one to two hours per day for children aged 4-6 years could help mitigate the negative developmental effects observed in this study [20]. Educators also play a vital role in educating parents about the potential dangers of excessive screen time and in promoting activities that foster physical, cognitive, and emotional development.

For policymakers, the study underscores the importance of setting guidelines for children's use of digital devices. Implementing public health campaigns and educational initiatives to inform parents and caregivers about the risks of excessive screen time could be beneficial. Additionally, schools could play an active role by providing alternative learning methods that encourage face-to-face interactions and physical activity, which are critical for young children's development.

V. CONCLUSION

This study aimed to investigate the relationship between digital game addiction and the developmental levels of preschool children aged 4-6 years at TK Handayani Surabaya. The results of this study confirmed that higher levels of gadget addiction are significantly correlated with delays in child development, particularly in cognitive, motor, and emotional domains. Specifically, children with higher levels of gadget addiction exhibited developmental delays, with 50% of the children in the mild addiction group showing a notable decrease in developmental milestones, and 10% of the children in the heavy addiction group demonstrating significant deviations in development. These findings underscore the detrimental effects of excessive screen time on children's growth and highlight the need for careful monitoring of screen usage among preschool-aged children. In light of these results, it is crucial for parents, caregivers, and educators to regulate screen time, ensuring that children engage in more physical and social activities

e-ISSN:2808-6422; p-ISSN:2829-3037
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that are essential for holistic development. Future research should explore the long-term impact of gadget addiction on child development, using longitudinal studies with larger and more diverse samples. Additionally, studies could focus on the specific types of content children engage with, to identify whether certain types of digital games contribute more to developmental delays than others. The insights gained from this study are pivotal for shaping future educational and parental strategies, ensuring that digital technologies are used in ways that support rather than hinder the developmental processes of young children.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to all those who have supported me throughout the course of this research. My deepest thanks go to my supervisor and the faculty members at TK Handayani Surabaya for their valuable guidance, expertise, and encouragement. I also appreciate the parents and teachers of the preschool children for their cooperation and participation in this study. Lastly, I extend my gratitude to my family and friends for their unwavering support and encouragement during the research process.

FUNDING

This research was supported in part by the Department of Nursing at the Polytechnic of Health Ministry Surabaya. The funding contributed to data collection, analysis, and the preparation of this manuscript. The authors declare that no additional external funding was received for this study.

DATA AVAILABILITY

The data supporting the findings of this study are available upon reasonable request from the corresponding author. Due to privacy and ethical considerations, the data will be provided only to qualified researchers who meet the criteria for access to confidential data.

AUTHOR CONTRIBUTION

Aida Novitasari conceptualized and designed the study, supervised the data collection, and contributed to writing and revising the manuscript. Enung Mardiyana H. assisted in the data collection and analysis, as well as reviewing the manuscript. Adin Mu'afiroh contributed to the literature review and data interpretation. Ananda Zara Eka Putri and Indriatie participated in the data analysis and manuscript revision. All authors approved the final version of the manuscript.

DECLARATIONS

ETHICAL APPROVAL

Ethical approval for this study is not explicitly documented or reported

CONSENT FOR PUBLICATION PARTICIPANTS

Informed consent for publication of the data and results from this study was obtained from the parents or legal guardians of the participants. The consent form included details about the study's aims, methodology, potential outcomes, and the publication of the findings. Participants' identities were anonymized to protect their privacy, and the publication was only conducted after consent was granted by the relevant parties.

COMPETING INTERESTS

The authors declare that they have no competing interests related to this study. There are no financial or personal relationships that could be perceived as influencing the results or interpretation of this research.

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