



Effect of Interactive 3D Multimedia Education on Improving Mothers' Knowledge of Stimulation for 24-Month-Old Toddlers

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Abstract. Stimulation is an activity that aims to optimize the development of toddlers by increasing basic abilities through interaction with the environment. This study aims to analyze the effect of applying interactive 3D media on increasing maternal knowledge about stimulation in toddlers aged 24 months in Cihanjuang Village, Parongpong Puskesmas working area. This study used a pre-experimental one-group pretest-posttest design with a total of 30 respondents selected according to the inclusion and exclusion criteria. Data collection was done through a structured questionnaire given before and after the use of interactive 3D media. The results of the pretest study showed that the majority (68.4%) of mothers who had toddlers aged 24 months at the Parongpong Health Center had poor knowledge about growth and stimulation, and the posttest results showed that almost half (47.4%) of mothers who had toddlers aged 24 months at the Parongpong Health Center in the year had good knowledge about toddler growth and stimulation. The results of statistical analysis using the Wilcoxon signed-rank test showed a p-value <0.05. These findings indicate that the use of interactive 3D media has a significant effect on increasing mothers' knowledge about toddler stimulation.

Keywords: Childhood Development, Health Promotion, Interactive 3D Media, Maternal Knowledge, Toddler Stimulation.

INTRODUCTION

Child development during the first few years of life is a foundational determinant of lifelong health, learning, and behaviour[1]. This period, often referred to as the golden age, is marked by rapid brain development, during which appropriate stimulation can significantly influence motor, language, cognitive, and socio-emotional growth. Stimulation refers to purposeful interaction with a child that helps activate and strengthen various developmental domains. Without adequate stimulation, especially during the first two years, children are at risk of developmental delays that may become permanent and impact their future well-being[2]. Globally, the World Health Organization (2018) estimates that more than 200 million children under the age of five do not reach their developmental potential, particularly in low- and middle-income countries. In Indonesia, according to the Ministry of Health (2020), around 13–18% of toddlers experience developmental problems. This figure rises in some regions, such as West Java, where approximately 30% of children show delayed development, and 1–3% suffer from motor delays[3]. These statistics underscore the urgent need for effective community-level interventions, particularly for families with limited access to quality early childhood education and developmental screening.

In Cihanjuang Village, located within the working area of Puskesmas Parongpong, West Bandung, although the toddler visit coverage reached a high percentage of 99%, preliminary findings revealed that several toddlers still exhibited signs of developmental delay. The Kuesioner Pra Skrining Perkembangan (KPSP) results from January 2025 showed that 5 out of 132 toddlers did not meet developmental milestones, including two 24-month-olds with notable delays. This situation points to

gaps not in access to services, but in the quality and effectiveness of health education and parental involvement in stimulation practices[4]. Current health education tools, such as the Kesehatan Ibu dan Anak (KIA) handbook and printed leaflets, although useful, often fail to fully engage mothers especially those with limited literacy or unfamiliarity with textual materials[5]. The limited interactivity and visual content of traditional media hinder the effectiveness of educational outreach, particularly when it comes to demonstrating techniques for child stimulation that are best taught visually and practically.

To address these challenges, this study introduces the use of interactive 3D media as an innovative health education tool. Interactive 3D learning enables users to visualise, manipulate, and interact with virtual objects—fostering deeper understanding, better memory retention, and increased learning motivation[6]. These advantages are particularly relevant in delivering maternal education on child stimulation techniques, which require visualisation, repetition, and clear step-by-step demonstration[7]. The objective of this study is to investigate the effectiveness of implementing interactive 3D media in increasing maternal knowledge regarding stimulation practices for 24-month-old toddlers in Desa Cihanjuang. Specifically, this study seeks to assess whether the 3D media intervention leads to a significant improvement in maternal understanding compared to traditional methods. This initiative aligns with the goals of the national Stimulasi, Deteksi dan Intervensi Dini Tumbuh Kembang (SDIDTK) program by enhancing early intervention through technological innovation[8].

As a solution, this research offers a novel integration of digital technology into rural maternal and child health services. By leveraging interactive 3D media, health workers such as midwives can deliver more engaging, accessible, and effective education to mothers, ultimately improving parental practices in early childhood stimulation [9]. By leveraging interactive 3D media, health workers such as midwives can deliver more engaging, accessible, and effective education to mothers, ultimately improving parental practices in early childhood stimulation. Scientifically, interactive digital media, particularly 3D-based tools, have been shown to enhance cognitive engagement, improve retention of health information, and accommodate various learning styles—especially among populations with lower literacy levels [10].

METHODS

1) Study Design

This study uses a quantitative pre-experimental one group pretest-posttest design[11]. This design measures the knowledge of mothers regarding stimulation of 24-month-old toddlers before and after the implementation of interactive 3D media. The comparison of pretest and posttest results will show the effectiveness of the media.

2) Population and Sample

The population in this study includes mothers of toddlers aged 24 months in Desa Cihanjuang, under the working area of Puskesmas Parongpong. The sample will be determined using total sampling of eligible participants who meet inclusion criteria, such as being a biological mother of a 24-month-old toddler and willing to participate in the study. For the total sample 38 respondents.

3) Experimental Setup

The intervention will be conducted by providing educational sessions using interactive 3D media designed to improve mothers' knowledge of early childhood stimulation. The media includes visual 3D simulations and interactive modules focusing on motor stimulation, cognitive, language and social development for toddlers aged 24 months. The sessions will be organized in collaboration with Posyandu and guided by trained health workers. The training is provided for 1 month for intervention and evaluation. using the following interactive 3D media: <https://viewer.assemblrworld.com/-bjC6Csajw645mdAPxou>.

4) Data Collection

Data will be collected through a structured questionnaire that has undergone validity and reliability testing. Research testing is conducted in two stages: 1) Pretest: Conducted before the introduction of interactive 3D media to assess baseline knowledge. 2) Posttest: Conducted after the intervention to evaluate changes in knowledge. Data collection was scheduled to take place within one month during public health service days at the Posyandu in Cihanjuang Village.

5) Data Analysis

5.1 Univariate Analysis

Analysis Univariate analysis will be used to describe the characteristics of participants and the distribution of each research variable. Data will be analyzed using descriptive statistics to describe participant characteristics and knowledge levels before and after the intervention.

5.2 Bivariat

To test the hypothesis, bivariate analysis will be conducted to identify significant differences between two related variables: mothers' knowledge before and after the use of interactive 3D media. The Wilcoxon signed-rank test will be used because the data are paired and categorical. A significance level of $p < 0.05$ will be considered statistically significant [13]. If the p-value is less than 0.05, it indicates a meaningful improvement in knowledge after the intervention.

6) Ethical Considerations

This study will follow ethical research principles, including informed consent, confidentiality, and voluntary participation. Ethical clearance will be obtained from the Ethics Committee of Institut Kesehatan Rajawali.

RESULTS AND DISCUSSION

The univariate analysis in this research includes the characteristics of the respondents, the level of knowledge of mothers with toddlers before the intervention regarding knowledge of development and stimulation of 24-month-old toddlers using interactive 3D media, and the distribution of the level of knowledge of mothers with toddlers after the intervention on knowledge of development and stimulation of 24-month-old toddlers using interactive 3D media.

Table 1. Respondent Criteria

Variable	Category	Frequency (f)	Percentage (%)
Age	21–30 years	31	81.6%
	31–40 years	7	18.4%
Education	Primary School	5	13.2%
	Junior High School	7	18.4%
	Senior High School	21	55.3%
	Diploma (D3)	2	5.3%
	Bachelor (S1)	3	7.9%
Occupation	Teacher	1	2.6%
	Housewife	32	84.2%
	Private Employee	3	7.9%
	Merchant	1	2.6%
	Entrepreneur	1	2.6%
Number of Children	1 Child	17	44.7%

2 Children	17	44.7%
3 Children	3	7.9%
4 Children	1	2.6%

Table 2. Description of Mothers' Knowledge Regarding the Development and Stimulation of 24-Month-Old Toddlers Before Being Given Interactive 3D Media in Cihanjuang Village, Working Area of Parongpong Public Health Center in 2025

<i>Pre-test</i>	Frequency (f)	Percentage (%)
Good	3	7,9
Fair	9	23,7
Poor	26	68,4
Total	38	100,0

Based on Table 2, it was found that the majority (68.4%) of mothers with 24-month-old toddlers in Cihanjuang Village, Working Area of Parongpong Public Health Center in 2025 had poor knowledge regarding development and stimulation before the intervention using interactive 3D media was conducted. A study by Wawan et al. revealed that several factors influence the developmental status of toddlers, including poor nutritional status, low socioeconomic background, and particularly the educational level of parents. Among these, the mother's education level is the most significant factor affecting toddler development, as the mother is the primary caregiver[14].

The pre-test results in this study showed that most mothers had low knowledge regarding toddler development and stimulation. Several factors are assumed to contribute to this. First, maternal age mothers over 30 years old may have limited access to up-to-date information and are more focused on other family responsibilities. Second, low educational background (elementary or junior high school) limits mothers' ability to comprehend and absorb health-related information, particularly about toddler development and stimulation[15]. Third, mother's occupation working mothers have limited time to seek or learn health information, while stay-at-home mothers may have limited access due to reduced social interaction or media exposure[16]. Fourth, number of children mothers with many children often rely on past experiences and may no longer seek new knowledge, whereas mothers with fewer children are still adapting and learning to care for their child[17]. Fifth, limited learning media most mothers rely solely on the Maternal and Child Health (MCH) book, and some no longer use or even own the book after their child's immunization is complete, thereby missing out on other vital health information, especially about development and stimulation[18].

These conditions highlight the need for educational interventions tailored to the mother's background, such as the use of easily accessible and understandable animated video media, like the "Interactive 3D Media" used in this intervention. Proper and appropriate stimulation during toddlerhood is a critical supporting factor for optimal physical, motor, cognitive, language, social, and emotional development[19]. Mothers with good knowledge and understanding of toddler development are better able to provide accurate stimulation, which can help prevent developmental delays and disorders[20].

Table 3. Description of Mothers' Knowledge Regarding the Development and Stimulation of 24-Month-Old Toddlers After Being Given Interactive 3D Media in Cihanjuang Village, Working Area of Parongpong Public Health Center in 2025

<i>Pre-test</i>	Frequency (f)	Percentage (%)
Good	18	47,4
Fair	17	44,7
Poor	3	7,9
Total	38	100,0

Based on Table 3, there was a significant improvement, with nearly half (47.4%) of mothers with 24-month-old toddlers in Cihanjuang Village, Working Area of Parongpong Public Health Center in 2025 having good knowledge regarding toddler development and stimulation after the intervention using interactive 3D media. This study aligns with the findings of Saputri et al., which showed that animated video media effectively increases mothers' knowledge about the importance of early developmental stimulation, especially through Tummy Time Exercise[21]. The study used a pre-experimental design with a pre-test and post-test involving 30 mothers of infants aged 0–6 months. Results indicated a significant improvement in knowledge ($p=0.000$).

In this study, interactive 3D media was proven to significantly enhance the knowledge of mothers with 24-month-old toddlers regarding child development and stimulation. The media provided various types of stimulation and interactive features that helped mothers learn and apply correct stimulation techniques[22]. After two weeks of use, mothers' knowledge improved by 39.5%, shifting from the "low" to "good" category. However, some mothers still struggled to answer specific questions due to limited enthusiasm or suboptimal use of the media. About 7.9% of respondents remained in the "low knowledge" category due to several factors: (1) technical issues such as unstable internet connectivity, (2) age-related difficulties in using technology, and (3) time constraints caused by work responsibilities and caring for multiple children.

Table 4. Differences in the Level of Knowledge of Mothers with 24-Month-Old Toddlers in Cihanjuang Village, Working Area of Parongpong Public Health Center in 2025 Regarding Toddler Development and Stimulation Before and After Being Given Interactive 3D Media

Knowledge of Mothers	N	Mean	Difference	P value
<i>Pre-test</i>	38	54,21	21,57	0,000
<i>Post-test</i>	38	75,78		

Based on Table 4, the univariate analysis results from the pre-test showed that the majority (68.4%) of mothers with 24-month-old toddlers in Cihanjuang Village, Working Area of Parongpong Public Health Center in 2025 had poor knowledge regarding development and stimulation before the intervention using interactive 3D media. Meanwhile, the univariate post-test results indicated that nearly half (47.4%) of the mothers had good knowledge regarding toddler development and stimulation after the intervention with interactive 3D media. The bivariate analysis showed a p -value of $0.000 < \alpha$ (0.005), which means the hypothesis is accepted. Therefore, there is a significant difference between the pre-test and post-test scores before and after the use of interactive 3D media in improving the knowledge of mothers with 24-month-old toddlers regarding toddler development and stimulation in Cihanjuang Village, Working Area of Parongpong Public Health Center in 2025.

Mothers with higher education levels and prior experience tended to comprehend and apply the information more easily[23]. Age also affected the mothers' ability to analyze the provided material. Post-test results showed that nearly half of the mothers fell into the "good knowledge" category, indicating the effectiveness of 3D media even among mothers with limited educational or experiential backgrounds. The researcher assumes that maternal knowledge is closely related to toddler development. Mothers with good knowledge are more capable of recognizing developmental milestones

and detecting delays early. While challenges such as limited digital access and low motivation exist, improved understanding enables mothers to take preventive measures and support their child's optimal growth and development.

CONCLUSIONS

This study concludes that the use of interactive 3D media significantly improved the knowledge of mothers regarding the stimulation of 24-month-old toddlers in Cihanjuang Village. The average knowledge score increased from 54.21 (pre-test) to 75.78 (post-test), with a p-value of 0.000, indicating a statistically significant difference. Interactive 3D media proved especially useful for mothers with limited educational backgrounds, offering engaging and accessible health education. Despite some technical barriers, it served as an effective tool to increase awareness of proper toddler stimulation. Future studies could explore the long-term behavioral impact of this media, expand its use in broader communities, and enhance features to support digital literacy and engagement.

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