

Effectiveness of a Digital Flipbook Intervention on Health Cadres' Knowledge Regarding Child Growth and Development Detection and Stimulation

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ABSTRACT

Introduction: Early detection and stimulation of child growth and development are crucial strategies for preventing developmental disorders. Health cadres play a pivotal role at the community level; however, their knowledge requires continuous enhancement through effective educational media. Digital flipbooks offer an interactive and independent learning approach. This study aimed to analyze the effectiveness of a digital flipbook intervention on health cadres' knowledge of child growth and development detection and stimulation.

Method: This study used a one-group pretest-posttest methodology in a quasi-experimental design. 74 health cadres from South Bangka Regency's Air Gegas District were chosen using total sampling. Data was collected using a 20-item validated knowledge questionnaire administered before and immediately after the educational intervention. The non-parametric Wilcoxon Signed-Rank Test was used with a significance level of $\alpha = 0.05$.

Results: The mean knowledge score of the cadres significantly increased from 83.71 (SD = 8.74) in the pretest to 94.72 (SD = 9.41) in the posttest. The pretest and posttest scores differed statistically significantly, according to the Wilcoxon Signed-Rank Test ($Z = -6.712$, $p = 0.001$).

Conclusion: The digital flipbook intervention demonstrated a significant improvement in health cadres' knowledge regarding the detection and stimulation of child growth and development, suggesting its potential as an effective educational medium. However, considering the limitations of the one-group pretest-posttest design, these findings should be interpreted as a preliminary evaluation. To establish its efficacy, more study using a randomised controlled trial is required.

Keywords: Child growth and development, digital flipbook, health cadres, health education, knowledge



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Introduction

Maternal and neonatal mortality, alongside child growth and developmental delays, remain critical public health challenges in developing countries, including Indonesia. Children represent the future generation and a vital component of national human resource development. Mothers and children are vulnerable groups requiring priority in health service provision due to their sensitivity to family and environmental conditions. Health maintenance efforts for infants and children must be directed toward preparing a healthy, intelligent, and quality generation, as well as reducing infant and child mortality rates.¹

Monitoring child growth and development is essential for identifying early signs of disorders. Data indicate that approximately 5–10% of children experience general developmental delays, two per 1,000 infants suffer from motor development disorders, three to six per 1,000 infants have hearing impairments, and one in 100 children has intellectual deficits and speech delays.² According to the 2023 Indonesian Health Survey (Survey Kesehatan Indonesia, SKI), stunting among Indonesian toddlers reached 21.5%, with an annual increase in the number of short and very short toddlers, making stunting a serious health issue requiring immediate intervention.³

Early detection and stimulation are imperative strategies to mitigate these developmental issues. However, during the COVID-19 pandemic, mothers of infants and toddlers became hesitant to bring their children to integrated healthcare posts (Pos Pelayanan Terpadu, *Posyandu*) for routine examinations, highlighting the need for innovative educational media that can empower cadres and mothers to perform independent growth monitoring. Health cadres, as community-level frontline workers, play a pivotal role in disseminating information and training mothers to independently monitor their children's growth and development.⁴ Interactive digital education media, such as flipbooks, have appeared as effective pedagogical tools.

Digital flipbooks integrate text, graphics, and video, making learning more interactive, enjoyable, and accessible, while also enabling cadres to review materials independently through their personal devices. Several previous studies have demonstrated that well-designed educational media can significantly enhance cadres' knowledge and performance in maternal and child health services.⁵ Nevertheless, research specifically evaluating the effectiveness of Canva-based digital flipbooks for training cadres on child growth and development detection remains limited. Considering this, the purpose of this study was to assess how well a digital flipbook intervention improved health cadres' understanding of how to identify and promote children's growth and development in Air Gegas District, South Bangka Regency.

Methods

This study used a one-group pretest-posttest methodology and a quantitative quasi-experimental design. The study was carried out in the South Bangka Regency's Air Gegas District, which is around 89 kilometers away from the central health referral center. The population comprised all health cadres in the district. 74 cadres in all, chosen using a complete sampling technique, took part in the study. The independent variable was the educational intervention using a digital flipbook developed using Canva and integrated with instructional videos. The dependent variable was the cadres' knowledge score regarding growth measurement and developmental stimulation.

The dependent variable was the cadres' knowledge score regarding growth measurement and developmental stimulation. The instrument used was a 20-item validated knowledge questionnaire developed by the researchers, covering four domains: basic concepts of growth and development (6 items), growth measurement (5 items), developmental detection and danger signs (4 items), and growth and development stimulation and the cadres' role (5 items). The maximum raw score was 20, which was then transformed to a scale of 0–100. Each right response received a score of 1, while each wrong response received a score of 0. The *pretest* was administered before the intervention, and the *posttest* was administered immediately after the educational session and practical demonstration concluded to measure short-term knowledge retention.

Statistical software was used to analyse the data. The demographic and knowledge scores were summarised using descriptive statistics (mean, standard deviation, frequency, and percentage). The Kolmogorov-Smirnov test was used to determine the normality of the data before hypothesis testing. The non-parametric Wilcoxon Signed-Rank Test was used to assess the significance of the difference between pretest and posttest scores because the posttest data were not normally distributed, with a significance level set at $p < 0.05$.

Universitas Negeri Gorontalo Health Research Ethics Committee accepted this study on September 29, 2023, with the number 091A/UN47.B7/KE/2023. Prior to their participation, each subject gave written informed consent, and the study rigorously protected their identities and data confidentiality.

Result

This study involved 74 health cadres in Air Gegas District, South Bangka Regency, who participated fully in the educational intervention and completed both the pretest and posttest assessments. The results are presented in logical sequence, starting with the demographic characteristics of the respondents, followed by the descriptive analysis of

knowledge scores, and concluding with the inferential statistical analysis of the intervention's effectiveness.

The demographic profile of the 74 participating health cadres is summarized in **Table 1**. Majority of respondents were in the productive age range of 31–40 years (40.5%). Most responders had finished senior high school (78.3%), indicating a sufficient educational foundation to comprehend the digital flipbook materials. Furthermore, the largest proportion of cadres had served for 6–10 years (43.2%), suggesting that they possessed adequate field experience. All participants in this study were female, which aligns with the general demographic composition of *Posyandu* cadres in Indonesia.

Table 1. Demographic characteristics of respondents (N = 74).

Characteristic	Category	Frequency	Percentage
Age (years)	21 – 30	15	20.2%
	31 – 40	30	40.5%
	41 – 50	20	27.1 %
	> 50	9	12.2%
Education Level	Junior High School	11	14.9%
	Senior High School	58	78.3%
	Diploma/Degree	5	6.8%
Length of Service	1 – 5 Years	22	29.7%
	6 – 10 years	32	43.2%
	>10 years	20	27.1%

This study's main goal was to evaluate the effectiveness of the digital flipbook intervention on the cadres' knowledge of child growth and development detection and stimulation. The descriptive analysis revealed a notable improvement in the cadres' knowledge scores following the digital flipbook intervention, as presented in **Table 2**. The descriptive analysis revealed a notable improvement in the cadres' knowledge scores following the digital flipbook intervention. The mean pretest score was 83.71 (SD = 8.74), indicating a moderately high baseline knowledge among the cadres prior to the intervention. After the educational session utilizing the flipbook media, the mean posttest score increased significantly to 94.72 (SD = 9.41). This upward shift in the mean score, along with an increase in the minimum score (from 60 to 70), reflects a substantial enhancement in their understanding of child growth and development detection and stimulation.

Table 2. Comparison of knowledge scores before and after intervention (N = 74).

Descriptor	Pretest	Posttest
Mean	83.71	94.72
Standard Deviation	8.74	9.41
Minimum Score	60	70
Maximum Score	100	100
Kolmogorov-Smirnov (sig)*	0.2	0.001*

*Significant at $p < 0.05$

The Kolmogorov-Smirnov test was used to perform a normality test prior to hypothesis testing. The findings showed that while the posttest data were not normally distributed ($\text{sig} = 0.001 < 0.05$), while the pretest data were normally distributed ($\text{sig} = 0.200 > 0.05$). The significance of the difference between the pretest and posttest scores was therefore ascertained using the non-parametric Wilcoxon Signed-Rank Test, as shown in **Table 3**. The Wilcoxon Signed-Rank Test yielded a Z-value of -6.712 with a p-value of 0.001 ($p < 0.05$). The mean difference between the pretest and posttest scores was 11.01 points, indicating a substantial improvement in cadres' knowledge following the digital flipbook intervention. It can be stated that there is a statistically significant difference between the pretest and posttest knowledge scores because the p -value is less than the predefined alpha level of 0.05. This finding confirms that digital flipbook intervention significantly improved the health cadres' knowledge regarding child growth and development detection and stimulation.

Table 3. Result of Wilcoxon Signed-Rank test on knowledge score.

Parameter	N	Z-value	p-value
Pretest-Posttest	74	-6.71	0.001*

*Significant at $p < 0.05$

Discussion

This study demonstrated that digital flipbook intervention significantly improved health cadres' knowledge regarding the detection and stimulation of child growth and development. The mean knowledge score increased from 83.71 in the pretest to 94.72 in the posttest, with a statistically significant difference ($p = 0.001$). These results are consistent with earlier studies showing that interactive digital instructional materials can successfully improve community health workers' knowledge and abilities.⁵

The in-depth effectiveness of flipbooks can be explained by their ability to stimulate

learners' engagement and interest through interactive features. Demonstrated flipbook media significantly increased students' learning interest compared to conventional methods, with post-test interest scores rising from the "low" to "very high" category.⁶ Similarly, Arisanti et al. found that interactive digital flipbooks effectively enhanced learners' creative thinking skills, with N-Gain scores reaching the moderate category.⁷ These findings corroborate the present study, suggesting that flipbooks serve not only as informational tools but also as catalysts for active learning and cognitive development.

Furthermore, the integration of instructional videos within the flipbook significantly improves information retention. Wachtler et al. showed that interactive learning videos with strategically positioned questions could transform passive watchers into active learners, thereby enhancing selective attention and long-term learning success.⁸ In the context of community health education, this mechanism explains how cadres who viewed video demonstrations of anthropometric measurements were able to form accurate mental models of the procedures, leading to better recall and application during routine Posyandu activities. This is consistent with Minar et al., who reported that digital learning media significantly improved students' creativity and skill acquisition in educational settings.⁹

From the perspective of conventional learning methods, traditional printed handouts and one-way lecture approaches often result in passive learning and rapid knowledge decay.^{10,11} In contrast, the Canva-based flipbook allows cadres to navigate the material at their own pace, reinforcing the learning process through self-directed exploration and repeated access to multimedia content. This aligns with Gumilar et al., who found that digital media-based contextual learning significantly improved learners' critical and creative thinking skills.¹² Using flip sheets to show information can expedite and simplify the transmission of communications by combining text and images.¹³

These findings are further supported by recent international research. Santosa et al. showed that the effectiveness of learning interventions targeted at enhancing creative thinking skills was greatly enhanced by contextually relevant and expert-validated teaching materials.¹⁴ Additionally, Anas and Hasibuan supported the idea that interactive digital learning materials improve student engagement and comprehension by confirming that digital flipbooks might raise scientific literacy in the disruptive era.¹⁵

The demographic characteristics of the respondents may also have contributed to the success of the intervention. The majority of cadres were in the productive age range (31–40 years, 40.5%), had at least a senior high school education (78.3%), and had served for 6–10 years (43.2%). This profile indicates that the cadres were relatively young, digitally literate,

and experienced enough to absorb and apply the new knowledge effectively. Age, education level, and information sources are recognized factors influencing individual knowledge.¹⁶

Furthermore, the practical advantages of the digital flipbook enhanced learning outcomes. Unlike traditional printed handouts or static presentations, the Canva-based flipbook can be accessed through personal smartphones, enabling cadres to review the materials independently at any time and in any location. This feature supports self-directed learning and continuous knowledge reinforcement, which is particularly valuable in remote areas. The flipbook also served as a reference tool that cadres could consult during their routine Posyandu activities, thereby improving the quality of growth monitoring and developmental stimulation provided to mothers and children.

Notwithstanding these favourable results, a number of restrictions should be noted. First, it is more difficult to credit the observed benefits to the intervention alone when using a one-group pretest-posttest design without a control group. Second, this study only measured short-term knowledge gains, without evaluating long-term knowledge retention or actual behavioral changes in cadres' daily practices. A randomised controlled trial design with a control group should be used in future studies and include follow-up assessments to evaluate the sustained impact of the flipbook intervention on cadres' competencies and, ultimately, on child growth and development outcomes at the community level.

Conclusion

The digital flipbook intervention demonstrated a significant improvement in health cadres' knowledge scores regarding the detection and stimulation of child growth and development in Air Gegas District, South Bangka Regency, suggesting its potential as an effective educational medium. The mean knowledge score increased significantly from 83.71 to 94.72 ($p = 0.001$). Nevertheless, taking into account the drawbacks of the one-group pretest-posttest design without a control group, these findings should be interpreted as a preliminary evaluation. Further research, with a more rigorous design with a control group, is needed to confirm its effectiveness and rule out potential confounding factors. It is recommended that the local health office consider adopting this digital medium as a sustainable educational tool for cadre training programs, while continuously evaluating its long-term impact.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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