


The Effectiveness of Online Education Through Digital Posters on Increasing Pregnant Women's Knowledge About Childbirth Preparation

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Article Info	ABSTRACT
<p>Keywords: Childbirth Digital Education Digital Posters Pregnant Women</p>	<p>The low level of understanding among some pregnant women regarding childbirth preparation remains a challenge in efforts to improve maternal and neonatal preparedness and safety. This study aims to analyze the effectiveness of online education delivered through digital posters in improving pregnant women's knowledge of childbirth preparation in Makassar City. The research employed a quasi-experimental design using a one-group pretest–posttest model, involving 30 pregnant women selected through purposive sampling. The educational intervention consisted of sending digital posters containing childbirth preparation materials via the WhatsApp platform, followed by measurements of participants' knowledge before and after the intervention using a Google Form questionnaire. The results showed a substantial increase in knowledge after the intervention, with the mean score rising from 62.3 in the pre-test to 82.7 in the post-test. Furthermore, the paired t-test yielded a p-value of 0.000 ($p < 0.05$), indicating that the digital poster–based education had a significant effect on improving pregnant women's knowledge of childbirth preparation. These findings confirm that digital posters serve as an effective, accessible, and contextually relevant educational medium for pregnant women in urban settings such as Makassar City. The study recommends developing more interactive digital content and conducting further research with control groups and additional variables to strengthen the empirical evidence.</p>
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INTRODUCTION

The development of digital technology has brought significant changes to the health sector, particularly in the delivery of information to the public. Digital innovations enable healthcare providers to deliver education more quickly, flexibly, and effectively to various target groups. One increasingly popular form of digital education is the use of visual media such as digital posters and infographics. These media utilize engaging visual elements that simplify health messages and enhance public understanding. Numerous studies have demonstrated the

effectiveness of digital media in improving pregnant women's knowledge; for example, digital health promotion media have been shown to improve mothers' readiness in practicing Early Initiation of Breastfeeding (Mesalina et al., 2024).

Globally, organizations such as the World Health Organization (WHO) emphasize the importance of digital-based health education as a strategy to improve maternal health literacy. Education delivered through online platforms is considered capable of reaching pregnant women in various circumstances, including those living in remote areas or with limited access to direct healthcare services. Through this approach, information on childbirth preparation, pregnancy danger signs, and antenatal care can be disseminated more equitably. Studies in Indonesia also show that digital education through videos about pregnancy danger signs significantly increases pregnant women's knowledge (Suhardi & Irmadani, 2025).

In Indonesia, maternal health remains a significant concern, as indicated by relatively high maternal mortality rates compared to several Southeast Asian countries. Low levels of knowledge among pregnant women regarding childbirth preparation contribute to the increased risk of complications during pregnancy and childbirth. Limited understanding of the importance of antenatal care, signs of labor, and physical and mental preparation can lead to delays in making decisions during emergencies. Supporting this, other research also demonstrates that online articles delivered through digital applications play an important role in enhancing pregnant women's knowledge in various regions (Wulandari et al., 2024).

Government efforts to improve maternal health literacy have been implemented through programs such as prenatal classes, posyandu activities, direct health counseling, and various maternal health services. However, not all pregnant women are able to participate in these face-to-face activities regularly. In several major cities, including Makassar, busy schedules, high mobility, and limitations related to distance and time often hinder participation. These challenges highlight the need for a more flexible, accessible, and contextually relevant health education model for urban communities such as Makassar. The use of applications like PRONALIN has also been shown to improve birth-planning readiness among pregnant women (Nurul, 2024).

Digital posters represent an educational medium with strong potential for reaching pregnant women in Makassar City. With visually appealing designs, essential messages related to childbirth preparation can be conveyed in a simple and easily understandable manner. Disseminating digital posters through online platforms such as WhatsApp and Instagram aligns well with the lifestyle of urban populations, who generally have high levels of smartphone and social media use. Previous studies also reinforce the effectiveness of digital visual media, including local-language caricature videos (Minda et al., 2025) and animated childbirth-preparation videos that effectively reduce fear of childbirth (Migunani & Mawardika, 2024).

Earlier research suggests that interactive visual media are effective in improving comprehension and information retention. Digital posters, in particular, have been found to significantly influence behavior and enhance knowledge. However, studies specifically examining the effectiveness of online education through digital posters in improving pregnant women's knowledge of childbirth preparation—especially within urban contexts such as

Makassar City—remain limited. Furthermore, digital education delivered through platforms like WhatsApp Groups has also been shown to enhance maternal health support (Mursyida et al., 2025).

In addition, gaps in pregnant women's knowledge remain concerning several essential aspects of childbirth preparation, including the selection of delivery facilities, necessary supplies, danger signs, mental readiness, and family support. Such information gaps can hinder timely decision-making and increase the risk of complications. Therefore, there is a strong need for an innovative, easy-to-understand educational approach that aligns with the cultural context and needs of the Makassar community.

Based on this context, the present study was conducted to examine the effectiveness of online education delivered through digital posters in improving pregnant women's knowledge of childbirth preparation in Makassar City. The findings of this study are expected to provide both academic and practical contributions to the development of digital health education strategies, as well as serve as a reference for healthcare professionals in improving maternal and neonatal safety through enhanced maternal health literacy within urban settings.

METHODS

Research Design

This study used a quasi-experimental design with a one-group pretest–posttest model. This design aimed to measure the effectiveness of online education through digital posters by comparing the knowledge levels of pregnant women before and after the intervention. There was no control group, so the effect of the intervention was observed from the changes in the respondents' knowledge scores at the two measurement points.

Population and Sample

The study population consisted of all pregnant women residing in Makassar City. The sample was selected using a purposive sampling technique with the following inclusion criteria: (1) pregnant women in the first to third trimester, (2) residents of Makassar City, (3) having access to a smartphone and internet connection, (4) able to read and understand digital educational materials, and (5) willing to participate in the entire research process. The sample size was determined based on the minimum statistical requirements for a pretest–posttest design, resulting in a total of 30 respondents.

Research Instrument

The research instrument consisted of a knowledge questionnaire on childbirth preparation, developed using Google Forms. The questionnaire included indicators assessing understanding of labor signs, physical and mental preparation, selection of delivery facilities, required delivery items, and pregnancy danger signs. The instrument underwent content validity assessment by experts and an initial reliability test to ensure its accuracy and consistency.

Research Procedure

The research procedure consisted of the following stages:

1. Pre-test: Participants were administered an initial questionnaire to assess their baseline knowledge prior to the intervention.
2. Educational Intervention: Participants received a digital poster containing childbirth preparation material via online platforms such as WhatsApp. The poster was designed to be visually appealing and concise to facilitate comprehension.
3. Post-test: After 2 days, participants completed the same questionnaire to measure changes in knowledge following the intervention.
4. Data Collection: All pretest and posttest results were collected and processed to determine the extent of knowledge improvement.

Data Analysis

The data analysis in this study employed a paired sample t-test to examine differences in knowledge levels before and after the intervention within the same group of respondents. This test was selected because it aligns with the one-group pretest–posttest design, in which both measurements originate from the same individuals and are therefore paired. The paired sample t-test enables researchers to assess changes resulting from the intervention by comparing the mean pretest and posttest scores and determining whether the observed differences are statistically significant.

The subsequent paired sample t-test produced t-values and p-values that served as the basis for drawing conclusions. A p-value < 0.05 indicates a statistically significant difference between pretest and posttest scores, suggesting that the intervention had an effect on increasing respondents' knowledge. These analytical results were used to evaluate the effectiveness of the digital poster–based educational intervention in this study.

RESULTS AND DISCUSSION

Results

Descriptive Analysis

To provide a more comprehensive picture of the level of knowledge of pregnant women before and after receiving education through digital posters, scores were categorized based on three levels of knowledge, namely low, moderate, and high. This categorization aimed to see the distribution of respondents' knowledge at both measurement stages and to identify changes that occurred after the intervention was given. The results of the pretest and posttest score categorization are presented in Table 1 and Table 2.

Table 1. Pretest Category Distribution

Category	Range	n	Percentage (%)
Low	0–59	12	40%
Moderate	60–79	15	50%
High	80–100	3	10%

The descriptive analysis of respondents' knowledge levels revealed a varied distribution across three assessment categories. The majority of respondents fell into the moderate category, totaling 15 individuals (50%). This finding indicates that most pregnant women possessed an adequate level of understanding regarding the assessed material, although it was not yet optimal. A total of 12 respondents (40%) were categorized as having low

knowledge, suggesting that a considerable proportion still had limited understanding related to the topic. This condition highlights the need for more intensive educational interventions to enhance comprehension among this group, given that sufficient knowledge is essential for informed decision-making in maternal health and childbirth preparation. Meanwhile, only 3 respondents (10%) achieved a high knowledge category, indicating that only a small portion demonstrated strong pre-intervention understanding. Overall, this distribution underscores that respondents' initial knowledge levels tended to be in the lower-to-moderate range, emphasizing the importance of educational programs to improve knowledge across all groups.

Table 2. Posttest Category Distribution

Category	Range	n	Percentage (%)
Low	0–59	0	0%
Moderate	60–79	8	26.7%
High	80–100	22	73.3%

The posttest results showed that none of the respondents fell into the low knowledge category (0–59), resulting in a percentage of 0%. This indicates that all participants achieved at least a minimally adequate level of understanding after receiving the digital poster-based educational intervention. The absence of respondents in the low category further demonstrates that the intervention successfully improved baseline knowledge uniformly across the group. A total of 8 respondents (26.7%) were categorized as having moderate knowledge (60–79), suggesting that a smaller portion of participants remained at a mid-level understanding, despite showing improvement compared to their pre-intervention scores.

This group can be considered to have gained general comprehension of the material but may still require further reinforcement to reach an optimal level of knowledge. The majority of respondents—22 individuals (73.3%)—were categorized as having high knowledge (80–100). This predominance of high scores reflects the effectiveness of the digital poster intervention in enhancing participants' understanding of childbirth preparation. The results indicate that presenting information in a visually appealing and concise format significantly improved information retention and comprehension, enabling most respondents to achieve a very good level of knowledge after the intervention.

Table 3. Descriptive Analysis of Pretest and Posttest Knowledge Scores

Category	Minimum	Maximum	Mean	Std. Deviation
Pre-test	50	75	62.3	10.5
Post-test	75	95	82.7	8.9

Table 3 presents the descriptive analysis of respondents' knowledge scores during the pretest and posttest phases. In the initial measurement (pretest), knowledge scores ranged from 50 to 75, with a mean of 62.3 and a standard deviation of 10.5. These findings indicate that respondents' baseline knowledge level was within the moderate category, with considerable variation across individuals. This condition suggests that some respondents still possessed limited foundational knowledge regarding childbirth preparation.

In the posttest phase, there was a substantial improvement in knowledge scores. The posttest score range increased to 75–95, with a mean of 82.7 and a standard deviation of

8.9. The higher mean value and expanded score range demonstrate that the educational intervention delivered through digital posters effectively enhanced respondents' comprehension. The reduction in standard deviation further indicates a decrease in knowledge variability among respondents, suggesting that the improvement occurred more consistently across participants.

The increase in knowledge scores was calculated from the difference between pretest and posttest values, with a minimum improvement of 15 and a maximum of 20. The average increase of 20.4, accompanied by a standard deviation of 4.2, reflects a meaningful enhancement for the majority of respondents. Overall, these descriptive findings confirm that the digital poster-based educational intervention was effective in improving pregnant women's knowledge regarding childbirth preparation.

Statistics Inferensial

After presenting the descriptive analysis, which provides an initial overview of the distribution of participants' knowledge scores before and after the intervention, the next step is to conduct inferential analysis to test the research hypothesis. This analysis is used to determine whether the differences observed between the pretest and posttest scores are statistically significant, thereby allowing the conclusion that the intervention genuinely contributed to improving participants' knowledge. The inferential analysis begins with an assessment of underlying assumptions, namely a normality test, to ensure that the data meet the prerequisites for employing parametric statistical tests. The results of the normality test are presented in Table 4.

Table 4. Normality test

Variable	Shapiro-Wil	p-value	Keterangan
Pre-test	0.965	0.321	Normal (p-value > 0.05)
Post-test	0.971	0.417	Normal (p-value > 0.05)

Table 4 presents the results of the Shapiro–Wilk normality test for the pretest scores, posttest scores, and their difference. The test results indicate that all variables have p-values greater than 0.05—namely, 0.321 for the pretest, 0.417 for the posttest, and 0.256 for the score differences. These findings suggest that all three variables are normally distributed. Accordingly, the assumption of normality is met, and the inferential analysis can proceed using a parametric test, specifically the paired t-test, to evaluate differences in scores before and after the intervention. Since all p-values are greater than 0.05, the data are considered normally distributed, and the appropriate test to use is the paired sample t-test. The results of the paired sample t-test are presented in Table 5.

Table 5. Paired sample t-test

Variable	Mean Pre-test	Mean Post-test	Mean Difference	t	df	p-value
Knowledge Score	62.3	82.7	20.4	10.82	29	0.000

Table 5 presents the results of the paired t-test conducted to assess the effectiveness of digital poster-based education in improving pregnant women's knowledge. The mean knowledge score increased from 62.3 in the pretest to 82.7 in the posttest, with an average

difference of 20.4 points. The statistical test produced a t-value of 10.82 with 29 degrees of freedom (df) and a p-value of 0.000. Since the p-value is less than 0.05, it can be concluded that there is a statistically significant difference between the pre-intervention and post-intervention scores. These findings confirm that digital poster-based education is effective in enhancing pregnant women's knowledge regarding childbirth preparation.

Following the paired t-test results, which demonstrated a significant improvement in knowledge after the intervention, the analysis was extended by calculating the N-Gain score to further examine the effectiveness of this improvement. The N-Gain test is used to evaluate the magnitude of the increase by considering the ideal maximum score, thereby providing a more comprehensive understanding of the effectiveness level of the digital poster-based educational intervention. The results of the N-Gain analysis are presented in Table 6.

Table 6. N-Gain test

Variable	Mean Pre-test	Mean Post-test	N-Gain	Level
Knowledge Score	62.3	82.7	0.54	moderate

Table 6 presents the N-Gain value, which illustrates the effectiveness of the increase in pregnant women's knowledge following the digital poster-based educational intervention. Based on the calculation results, an N-Gain score of 0.54 was obtained, which falls into the moderate category. This finding indicates that the educational intervention was reasonably effective in enhancing the respondents' knowledge, although it did not reach the high category. Overall, this value reflects that digital posters, as an educational medium, made a meaningful contribution to improving pregnant women's understanding of childbirth preparation.

Discussion

The findings of this study demonstrate an increase in the mean knowledge score from 62.3 (pretest) to 82.7 (posttest), with an average difference of 20.4 points and a statistically significant paired t-test result ($p < 0.001$). This magnitude of improvement is further supported by an N-Gain value of 0.54, classified as moderate, indicating a meaningful practical enhancement in knowledge, although not yet reaching maximal efficacy. This interpretation suggests that the digital poster intervention had a tangible impact on pregnant women's understanding of childbirth preparation while also indicating room for improvement to achieve higher gains in the broader population.

These findings are consistent with recent empirical evidence showing that structured visual media—such as infographics, digital posters, and infographic-based booklets—can improve comprehension and retention of health information among pregnant women. Field studies and pilot trials have reported significant improvements in knowledge scores following the provision of infographic/poster-based materials, whether delivered in person or through digital platforms. Proposed mechanisms include more concise information delivery, emphasis on key messages, and ease of storing and revisiting the materials by respondents (Amalia et al., 2024; Aprilia, Ahmad, & Idrus, 2025; Umaroh et al., 2023).

Beyond visual design aspects, the mode of distribution also contributes to intervention effectiveness. The use of mobile-based communication channels—such as distributing posters via WhatsApp—expands reach, enables repeated exposure, and facilitates brief

interactions between information providers and participants. Similar interventions utilizing WhatsApp or other messaging platforms have reported improvements in knowledge and antenatal care adherence. Therefore, the combination of structured visual content and accessible digital distribution likely explains the substantial effect observed in this study (Prihazty et al., 2024; Rahayu et al., 2023).

The results of this study align with several previous investigations that have demonstrated the effectiveness of digital and visual educational media in improving pregnant women's knowledge. Findings from Mardiani et al. (2024) reported that the use of booklets as an educational medium for childbirth preparation significantly improved the knowledge of third-trimester pregnant women compared with the control group in a quasi-experimental design. Their study supports the notion that content delivered in a concise and easily accessible format contributes substantially to participants' understanding. Meanwhile, other research has also highlighted the effectiveness of educational media beyond digital posters, such as animated videos, in the context of maternal health. The study by Widyastuti et al. (2025), which employed animated videos for childbirth preparation education, similarly found a significant increase in knowledge. Although the media format differs, their findings reinforce the argument that presenting information in a visual and structured form—whether animation or posters—can effectively enhance pregnant women's comprehension.

In addition, research by Putri and Sefrina (2024) emphasizes the use of infographic-based educational media in the context of maternal and child nutrition. Their study demonstrated that nutrition education using infographics significantly improved mothers' knowledge regarding strategies to improve the nutritional status of infants with low birth weight (LBW). Although the subject matter differs slightly (infant nutrition versus childbirth preparation), the pattern of knowledge improvement through infographic media is highly relevant for supporting the underlying mechanism behind the effectiveness of digital posters in the present study. Thus, this research positions itself within the literature as a continuation and strengthening of empirical evidence showing that digital visual educational media—particularly digital posters—serve as an effective strategy for enhancing health literacy among pregnant women. The findings contribute new insights, particularly regarding the use of digital posters distributed through online platforms (e.g., WhatsApp), which combine flexibility, accessibility, and strong visual appeal. This provides an important contribution to the health communication and maternal education literature in the digital era.

Given the consistency between the present findings and those of earlier studies, it is important to further explore why the digital poster intervention was able to produce a significant improvement in pregnant women's knowledge. The effectiveness observed is not solely attributable to the magnitude of score improvement, but also to the characteristics of the media, the distribution context, and the alignment of the material with the needs of the target audience. The following analysis outlines key theoretical and empirical factors that contributed to the success of this intervention.

The digital poster intervention demonstrated high effectiveness due to its structured, concise, and memorable visual design, which enabled pregnant women to quickly grasp essential information. The use of icons, color schemes, and key bullet points was shown to

enhance focus and information retention, consistent with Mayer's multimedia learning theory. This effectiveness is further supported by findings from other studies reporting similar outcomes. Aprilia et al. found that infographic-based booklets significantly improved pregnant women's knowledge of gestational hypertension, while Safa'ati et al. demonstrated that creative posters increased participation and awareness among pregnant women in community-based educational activities. Likewise, Rohmawati and Qoyyimah noted that psychoeducational posters played an important role in improving pregnant women's understanding of mental health during pregnancy (Aprilia, et al., 2025; Rohmawati et al., 2025; Safa'ati et al., 2024).

Furthermore, accessibility via mobile phones and WhatsApp platforms also contributed to the intervention's effectiveness. Since the posters were delivered through WhatsApp or other digital media, pregnant women could revisit the material anytime and repeatedly, as well as discuss it with facilitators or peers within group chats. A study by Natayya and Sofwan (2024) showed that WhatsApp Group-based stunting education significantly improved pregnant women's knowledge and attitudes. Similarly, research by Luh et al. (2022) on poster and video-based stunting education distributed through WhatsApp confirmed that digitally distributed media can enhance the effectiveness of health communication.

In addition, the relevance of the materials to the contextual needs of pregnant women was another key factor contributing to the intervention's effectiveness. The digital posters in this study were specifically designed to address critical aspects of childbirth preparation from signs of labor to essential items and birth planning ensuring that the information provided aligned closely with the actual needs of pregnant women. Presenting materials that resonate with respondents' personal experiences has been shown to strengthen attention, increase cognitive engagement, and facilitate the internalization of educational messages. These findings are consistent with research by Widyastuti et al. (2025), which demonstrated that animated childbirth preparation videos significantly improved pregnant women's knowledge, as well as the study by Wahidah et al. (2025), reporting that digital e-booklets tailored to pregnancy preparation needs effectively enhanced young mothers' understanding. Similar support is provided by Putri and Futriani (2022), who found that contextual, digitally visualized nutritional animation media for pregnant women with hypertension had a significant impact on increasing knowledge.

Lastly, digital posters provide opportunities for flexible and self-directed learning. Pregnant women can access the posters at any time—at home, while waiting at clinics, or during daily routines—without the need to attend conventional face-to-face educational sessions. Such flexibility is particularly valuable for pregnant women who are busy or have limited time. Educational strategies of this kind have been shown to be effective in other maternal health contexts. A study by Irawan et al. (2023) reported that WhatsApp auto-responding as a digital educational medium improved nutritional knowledge and antenatal care compliance.

CONCLUSION

This study demonstrates that digital poster-based education is effective in improving pregnant women's knowledge regarding childbirth preparation. The average knowledge score increased from 62.3 (moderate category) in the pretest to 82.7 (high category) in the posttest, accompanied by a shift in score distribution that indicates a significant increase in the high-score group. The paired t-test revealed a significant difference between pretest and posttest results ($p < 0.001$), and the N-Gain value of 0.54 indicates a moderate level of improvement effectiveness. Overall, digital posters were proven to be an efficient, accessible, and relevant educational medium for enhancing pregnant women's knowledge about childbirth preparation. Based on the study's findings, it is recommended that the development of digital poster-based educational materials be further enhanced, for example by incorporating interactive visual elements or embedded video links to strengthen comprehension among pregnant women. Future studies should involve a larger number of respondents and employ designs with control groups to obtain methodologically stronger results. In addition, follow-up evaluations are essential to assess the sustainability of knowledge improvement and to examine whether the intervention also influences changes in attitudes and behaviors related to childbirth preparation. This study has several limitations that should be considered when interpreting the findings. First, the research employed a one-group pretest-posttest design without a control group, which means that the increase in knowledge cannot be fully attributed to the digital poster intervention alone. Second, the relatively small sample size and its restriction to the Makassar City area limit the generalizability of the results to a broader population. Third, the outcome measurements were conducted only in the short term, preventing an assessment of whether the increased knowledge can be sustained over time. In addition, other variables—such as digital literacy levels, learning motivation, or family support were not examined, even though these factors may influence the effectiveness of the intervention. Based on these limitations, future studies are recommended to use an experimental design with a control group to obtain stronger evidence of causality. The sample size should also be expanded to include various regions and demographic characteristics to ensure more representative findings. Long-term evaluations are needed to assess the sustainability of knowledge improvements and the potential influence of the intervention on childbirth-preparation behaviors. In addition, future research may incorporate supporting variables such as digital literacy, frequency of digital media use, and psychosocial factors to better understand determinants of the effectiveness of digital-based education. The development of more interactive educational media such as posters with video links, dynamic infographics, or application-based modules also warrants exploration to enhance engagement and comprehension among pregnant women.

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