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The Effect of Digital Pocketbook on Anemia-Related Health Literacy and Anemia Prevention Awareness among Elementary School Students

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Abstract
Anemia remains a significant health concern among school-aged children because it can adversely affect cognitive development, concentration, academic performance, and overall well-being. Despite the importance of early prevention, many elementary school students have limited understanding of anemia-related health information, which may hinder the development of preventive health awareness. This study aimed to examine the effect of a Digital Pocketbook on health literacy and anemia prevention awareness among elementary school students. A quantitative study employing a quasi-experimental pretest–posttest control group design was conducted among 60 fifth-grade students selected through purposive sampling and assigned to an intervention group (n = 30) and a control group (n = 30). The intervention consisted of a multimedia-based Digital Pocketbook containing visual illustrations, concise learning modules, and interactive reflective activities related to anemia prevention, which was implemented for four weeks. Data were collected using the Health Literacy Questionnaire for Elementary Students (HLQ-ES) and the Anemia Prevention Awareness Questionnaire (APAQ). The results revealed that students in the intervention group experienced significantly greater improvements in health literacy and anemia prevention awareness than those in the control group ($p < 0.001$). Large effect sizes were observed for health literacy ($d = 1.85$) and anemia prevention awareness ($d = 1.92$), indicating substantial educational benefits of the intervention. These findings suggest that the Digital Pocketbook is an effective educational medium for strengthening students' understanding of anemia-related health information and enhancing preventive health awareness. Future studies should investigate whether these improvements translate into sustained preventive health behaviors.

Keywords: Anemia Prevention Awareness, Digital Pocketbook, Elementary School Students, Health Literacy

Introduction

Health literacy has become an increasingly important issue in elementary education because it plays a crucial role in shaping children's ability to access,

understand, evaluate, and apply health information in their daily lives. Students with adequate health literacy tend to demonstrate healthier behaviors, make informed health-related decisions, and develop positive attitudes toward disease prevention from an early age (Boxtel et al., 2024). In the context of primary education, health literacy is not only associated with cognitive understanding but also contributes to the development of lifelong healthy habits that support children's overall well-being and academic performance (World Health Organization, 2024a).

One of the health problems that remains prevalent among school-age children is anemia. Anemia is a condition characterized by low hemoglobin levels that can negatively affect physical growth, cognitive development, concentration, learning achievement, and overall quality of life among children (World Health Organization, 2024a). Although anemia is often associated with adolescents, several studies have reported that inadequate nutritional knowledge and limited awareness regarding anemia prevention may begin during elementary school years, emphasizing the importance of early preventive education (Bakhtiarvand et al., 2025). Therefore, introducing anemia prevention education at the elementary school level is essential to foster healthy lifestyles and increase students' awareness of nutritional health.

According to the Indonesian Health Survey (Kementerian Kesehatan, 2023), anemia remains a significant public health and nutritional concern among Indonesian children and adolescents. The survey reported that nutritional problems related to iron deficiency continue to affect school-age populations and may contribute to reduced concentration, learning performance, and overall educational achievement. Despite various health promotion programs implemented in schools, many students still demonstrate limited health literacy and inadequate awareness regarding balanced nutrition and anemia prevention. These conditions indicate the need for innovative educational interventions that are capable of delivering health information in an engaging, accessible, and age-appropriate manner. Therefore, integrating digital learning media into elementary education may provide an effective strategy to improve students' understanding of anemia prevention and promote healthy behaviors from an early age (Kementerian Kesehatan, 2024).

Although digital learning media have been increasingly utilized in health education, most previous studies have focused on improving general health knowledge, learning motivation, or health-related behaviors among adolescents and secondary

school students. Evidence regarding the use of Digital Pocketbooks in elementary school settings remains limited, particularly in relation to anemia prevention. Furthermore, few studies have simultaneously examined health literacy and anemia prevention awareness as complementary educational outcomes. This gap is important because health literacy serves as a foundation for students' ability to access, understand, and apply health information, while awareness of anemia prevention may support the development of informed health decisions from an early age. Therefore, this study investigates the effect of a Digital Pocketbook on health literacy and anemia prevention awareness among elementary school students (Aji et al., 2026a).

Health education in elementary schools is commonly delivered through conventional teaching approaches, such as lectures and printed materials. However, traditional teaching methods may have limitations in optimizing students' active engagement and motivation to learn health-related topics. (Zhamantayev et al., 2023). The rapid advancement of educational technology has encouraged educators to integrate digital learning media into classroom instruction. Digital learning resources provide interactive, flexible, and engaging learning experiences that can improve students' understanding and retention of educational content (Wei et al., 2024). Among various digital learning media, digital pocketbooks have emerged as practical educational tools because they can be accessed through smartphones and other digital devices, allowing students to learn independently anytime and anywhere.

A digital pocketbook is a concise digital learning resource that presents educational content in an attractive, accessible, and student-friendly format. The digital pocketbook developed in this study was specifically designed for elementary school students by incorporating colorful visual illustrations, concise microlearning content, simple navigation features, age-appropriate language, and interactive reflective activities. These pedagogical features were intended to enhance students' engagement, facilitate comprehension of health-related information, and support knowledge retention while reducing cognitive overload. Unlike conventional electronic modules that often rely on lengthy textual explanations, the digital pocketbook provides short and visually engaging learning units that are more suitable for the developmental characteristics of elementary school learners. Previous studies have demonstrated that digital pocketbooks can improve students' knowledge, learning motivation, and learning outcomes across various educational contexts (Aji et al., 2026a). In health

education settings, digital pocketbooks have also shown potential in enhancing students' understanding of health-related topics and promoting positive health behaviors (Rizkasari et al., 2025). Nevertheless, most previous studies have primarily focused on knowledge acquisition, while limited attention has been given to broader educational outcomes such as health literacy and health awareness.

Previous studies have demonstrated that digital learning media can improve students' knowledge, motivation, and learning outcomes across various educational contexts (Haleem et al., 2022). However, most existing studies have primarily focused on adolescents and secondary school students, while evidence involving elementary school students remains relatively limited (Triyani et al., 2020). Furthermore, previous research has largely examined health knowledge or health behavior as separate outcomes, with limited attention given to the integrated development of health literacy and anemia prevention awareness among younger learners (Rotar, 2025). In addition, empirical evidence regarding the implementation of digital pocketbook-based health education in Indonesian elementary school settings remains scarce (Zainuddin, 2026). Therefore, further research is needed to evaluate the effectiveness of digital pocketbooks in simultaneously enhancing health literacy and anemia prevention awareness among elementary school students.

The novelty of this study lies in the implementation of a digital pocketbook as an innovative educational medium designed specifically to enhance both health literacy and anemia prevention awareness among elementary school students. Unlike previous studies that primarily focused on increasing knowledge, this study evaluates the broader educational impact of digital learning media by examining students' ability to understand health information and develop awareness regarding anemia prevention simultaneously. This integrated approach is expected to contribute to the advancement of health education practices in elementary schools and provide evidence-based recommendations for educators seeking to promote preventive health behaviors through digital learning resources (Porlán-Ariza et al., 2026).

Based on the literature and theoretical foundations of digital learning and health literacy, this study assumes that the use of a digital pocketbook as an interactive learning medium can facilitate students' access to health-related information and improve their understanding of anemia prevention. Improved understanding of health information may contribute to higher levels of health literacy, which in turn can support the

development of greater awareness regarding anemia prevention among elementary school students. Therefore, the conceptual framework of this study illustrates the relationship between digital pocketbook utilization, health literacy, and anemia prevention awareness among elementary school students.

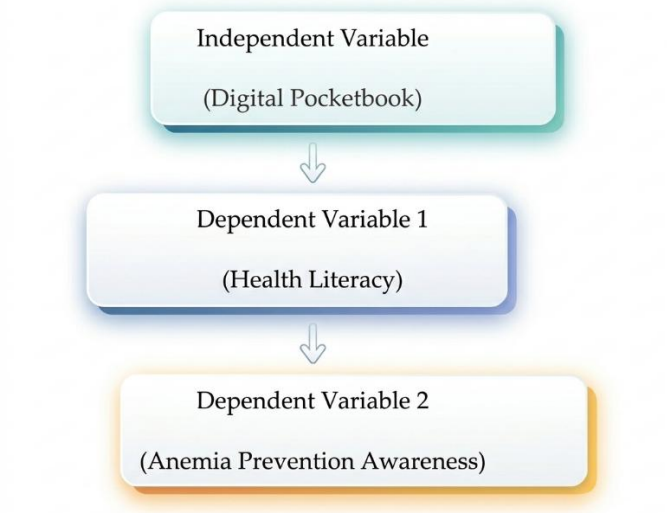

Figure 1 Conceptual Framework of the Study

Therefore, this study aims to examine the effect of a digital pocketbook on health literacy and anemia prevention awareness among elementary school students.

Research Method

This study employed a quantitative approach using a quasi-experimental design with a pretest-posttest control group design. This design was selected because it enables researchers to evaluate the effect of a digital pocketbook intervention on elementary school students' health literacy and anemia prevention awareness by comparing score changes before and after the intervention between the intervention and control groups (Yakavets et al., 2023). Quasi-experimental designs are widely used in educational research because they provide empirical evidence regarding the effectiveness of instructional interventions in real-world settings without requiring full randomization of participants (Nzioki & Korir, 2020).

The study was conducted from January to March 2026 at a public elementary school in Karanganyar Regency, Central Java, Indonesia. The study population consisted of all fifth-grade students enrolled at the school, totaling 84 students. Fifth-grade students were selected because they possess sufficient reading comprehension skills, are capable of understanding digital information, and can independently complete research

instruments (Print et al., 2024). The study population consisted of 84 fifth-grade students enrolled at the selected school. Initially, all students were screened for eligibility based on the predefined inclusion criteria, including active enrollment in Grade 5, ability to operate basic digital devices, parental or guardian consent, and willingness to participate throughout the study period. Of the 84 students assessed for eligibility, 60 met all inclusion criteria and were recruited into the study using purposive sampling. Students who did not meet the inclusion criteria or did not obtain parental consent were excluded from participation. The participants were assigned to the intervention group ($n = 30$) and the control group ($n = 30$) based on pre-existing intact classroom groups. One Grade 5 classroom was designated as the intervention group, while another Grade 5 classroom served as the control group. This grouping strategy was employed to preserve the natural classroom environment and maintain the feasibility of implementing the educational intervention within the school setting. Prior to the intervention, baseline equivalence between the intervention and control groups was assessed using independent samples t-tests on pretest scores of health literacy and anemia prevention awareness. The results indicated no statistically significant differences between groups at baseline ($p > 0.05$), suggesting that the two groups were comparable before the intervention was implemented.

The intervention consisted of the use of a Digital Pocketbook for Anemia Prevention Education, which was developed by the researchers based on health literacy principles and the developmental characteristics of elementary school students. The digital pocketbook contained educational materials on the definition of anemia, causes of anemia, signs and symptoms, the impact of anemia on health and academic performance, iron-rich food sources, the importance of healthy breakfast habits, and strategies for anemia prevention among school-aged children. The learning material was presented in an interactive digital format accessible through smartphones and computers, enabling students to learn independently and flexibly (Sun et al., 2024).

Prior to implementation, the digital pocketbook underwent a validation process involving two experts in health education and two experts in instructional media. Content validity was assessed using Aiken's V coefficient based on evaluations from two health education experts and two instructional media experts. The validation checklist covered material relevance, readability, visual design, usability, and appropriateness for elementary school students. The overall Aiken's V value was 0.89, exceeding the

recommended threshold of 0.80 and indicating excellent content validity. Feedback provided by the experts was subsequently used to revise and refine the digital pocketbook prior to implementation (Fohlin, 2025). Feedback from the validation process was used to revise and refine the digital pocketbook before its application in the intervention group.

Data were collected using two research instruments. The first instrument was the Health Literacy Questionnaire for Elementary Students (HLQ-ES), adapted from the health literacy framework proposed and modified to suit the characteristics of elementary school learners. The questionnaire consisted of 20 items measuring students' ability to access, understand, and utilize health-related information. The second instrument was the Anemia Prevention Awareness Questionnaire (APAQ), comprising 15 items designed to assess students' awareness of anemia prevention through healthy lifestyle practices and nutritious food consumption. Both instruments employed a four-point Likert scale ranging from 1 to 4. Prior to implementation, content validity was evaluated by three experts in health education and elementary education using Aiken's V coefficient. The HLQ-ES and APAQ achieved Aiken's V values of 0.89 and 0.91, respectively, indicating excellent content validity. Construct validity was subsequently examined using Pearson's product-moment correlation, while reliability was assessed using Cronbach's alpha, with a minimum acceptable value of 0.70 (Politi et al., 2021).

The HLQ-ES demonstrated satisfactory construct validity, with item-total correlation coefficients ranging from 0.42 to 0.81. The instrument achieved a Cronbach's alpha coefficient of 0.89, indicating excellent internal consistency. Similarly, the APAQ showed item-total correlation coefficients ranging from 0.45 to 0.84 and a Cronbach's alpha coefficient of 0.87, indicating good reliability (Shishov et al., 2022).

The Digital Pocketbook was developed by the researchers following a systematic process consisting of needs assessment, content development, expert validation, revision, and pilot testing. The educational content was prepared based on national guidelines for anemia prevention, health literacy principles, and the developmental characteristics of elementary school students. The Digital Pocketbook included topics on the definition of anemia, causes, signs and symptoms, consequences for health and academic performance, iron-rich foods, healthy breakfast habits, and anemia prevention strategies. Prior to implementation, the content and design were reviewed by experts in health education and instructional media, and revisions were made based on their

recommendations to ensure content accuracy, readability, and suitability for elementary school learners.

The research procedure began with the administration of a pretest to both groups to assess baseline levels of health literacy and anemia prevention awareness. Following the pretest, students in the intervention group participated in a four-week Digital Pocketbook-based learning program. During Week 1, students learned about the definition, causes, and signs and symptoms of anemia. Week 2 focused on the impact of anemia on health, concentration, and academic performance. Week 3 introduced iron-rich food sources and healthy breakfast habits, while Week 4 emphasized practical strategies for anemia prevention and healthy lifestyle practices. Students independently accessed the Digital Pocketbook using smartphones or computers and completed short reflective learning activities at the end of each module. Teacher facilitation was provided through weekly discussions, question-and-answer sessions, and reinforcement of key health messages. Meanwhile, students in the control group received conventional health education through lectures and printed textbooks covering the same topics. Following the completion of the intervention period, both groups completed a posttest using the same instruments to measure changes in outcomes.

Data analysis was conducted using IBM SPSS Statistics version 27. Descriptive statistics were used to summarize participant characteristics and the distribution of health literacy and anemia prevention awareness scores. The normality of the data was assessed using the Shapiro–Wilk test because the sample size was fewer than 100 participants (Ma, 2024). Homogeneity of variance was evaluated using Levene's Test. For normally distributed data, within-group differences between pretest and posttest scores were analyzed using paired samples t-tests. To evaluate the effect of the intervention while controlling for baseline differences, analysis of covariance (ANCOVA) was performed, with posttest scores as the dependent variables, group assignment as the fixed factor, and pretest scores as covariates. Effect sizes were estimated using partial eta squared (η^2) to determine the practical significance of the intervention. If the data were not normally distributed, Wilcoxon signed-rank tests and Mann–Whitney U tests were employed as nonparametric alternatives. In addition, effect size was calculated using Cohen's d to determine the practical significance of the intervention. Statistical significance was established at $p < .05$ (Eze et al., 2025).

Prior to data collection, permission was obtained from the school administration, and written informed consent was secured from parents or guardians. All participants were informed about the study objectives, procedures, benefits, and their right to withdraw at any time without penalty. Participant confidentiality and anonymity were strictly maintained throughout the study. The research was conducted in accordance with ethical principles for educational research and the Declaration of Helsinki (Parums, 2024).

Results and Discussion

Digital Pocketbook Product Description

To support the implementation of the intervention, a Digital Pocketbook for Anemia Prevention Education was developed and utilized as the primary learning medium. The digital pocketbook was specifically designed according to the developmental characteristics of elementary school students and incorporated visual illustrations, concise explanations, interactive learning content, and practical health messages related to anemia prevention. The product was validated by experts in health education and instructional media prior to implementation.

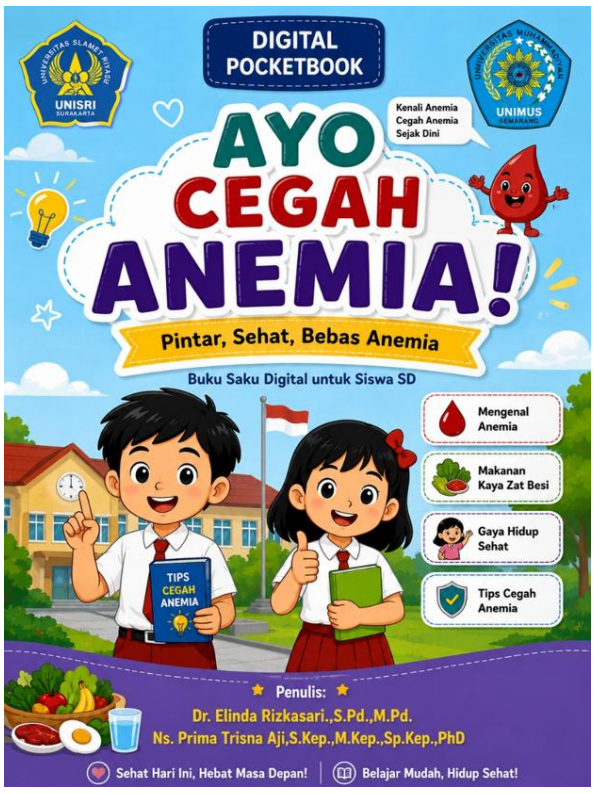

Figure 2 Cover Page of the Digital Pocketbook

Figure 2 presents the cover page of the Digital Pocketbook for Anemia Prevention Education. The cover was designed using attractive visual elements and age-appropriate illustrations to increase students' interest and motivation to engage with health-related learning materials.

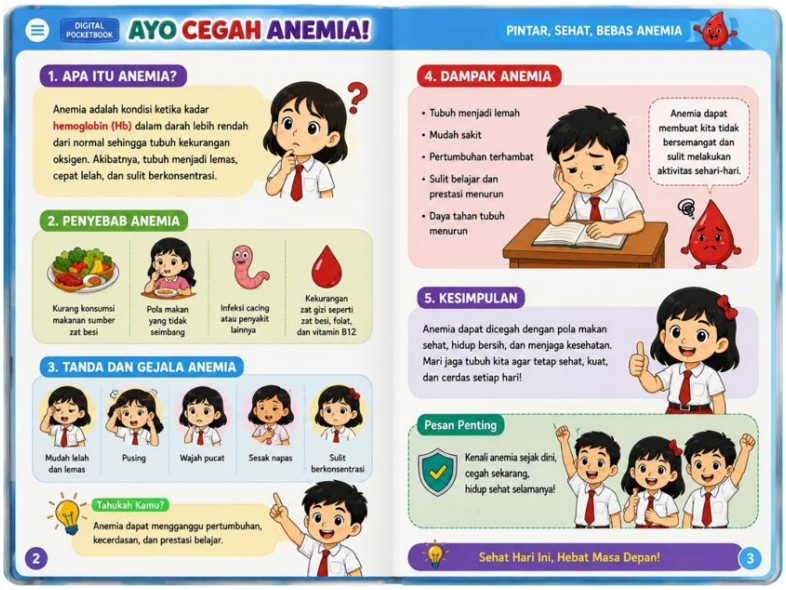

Figure 3 Example of Anemia Prevention Learning Content

Figure 3 illustrates one of the learning pages included in the digital pocketbook. The content provides information regarding the definition of anemia, common causes, signs and symptoms, and potential consequences of anemia among school-aged children. The material was presented using simple language and visual representations to facilitate students' understanding.

Figure 4 Example of Iron-Rich Foods Educational Content

Figure 4 presents educational content regarding iron-rich foods and healthy dietary habits that support anemia prevention. The use of colorful illustrations and practical examples was intended to increase students' awareness of healthy nutrition and encourage the adoption of positive dietary behaviors.

Figure 5 Example of Anemia Prevention Recommendations

Figure 5 displays recommendations for anemia prevention among elementary school students, including healthy breakfast habits, consumption of nutritious foods, adequate hydration, and maintaining a healthy lifestyle. This section was designed to promote preventive health awareness and encourage students to apply healthy behaviors in their daily lives.

Characteristics of Respondents

This study involved 60 elementary school students, comprising 30 students in the intervention group and 30 students in the control group. The demographic characteristics of the participants, including gender and age distribution, are presented in Table 1.

Table 1 Characteristics of Respondents (n = 60)

Characteristics	Intervention n (%)	Control n (%)	Total n (%)
Gender			
Male	14 (46.7)	15 (50.0)	29 (48.3)
Female	16 (53.3)	15 (50.0)	31 (51.7)
Age			
10 years	12 (40.0)	11 (36.7)	23 (38.3)
11 years	18 (60.0)	19 (63.3)	37 (61.7)

As shown in Table 1, the majority of respondents were 11 years old (61.7%), while female students constituted slightly more than half of the total sample (51.7%). The distribution of age and gender characteristics was relatively balanced between the intervention and control groups, indicating comparable baseline demographic characteristics. This balance reduces the likelihood of selection bias and strengthens the internal validity of the study by ensuring that observed differences in outcomes are more likely attributable to the intervention rather than demographic variations between groups.

Table 2 Shapiro Wilk Normality Test Results

Variable	Group	p-value
Health Literacy	Intervention	0.123
Health Literacy	Control	0.211
Anemia Prevention Awareness	Intervention	0.176
Anemia Prevention Awareness	Control	0.089

The Shapiro–Wilk normality test results are presented in Table 2. The results showed that all variables were normally distributed ($p > 0.05$). Therefore, parametric statistical analyses were considered appropriate for subsequent hypothesis testing.

Assumption Testing: Homogeneity of Variance

Prior to conducting the independent samples t-test, a homogeneity of variance test was performed using Levene's Test to determine whether the variance of scores between the intervention and control groups was equal. The results are presented in Table 3.

Table 3 Homogeneity of Variance Test Using Levene's Test

Variable	Levene Statistic	p-value
Health Literacy	0.71	0.401
Anemia Prevention Awareness	0.65	0.428

The results of Levene's Test showed that the p-values for health literacy ($p = 0.401$) and anemia prevention awareness ($p = 0.428$) were greater than 0.05, indicating that the variances of both variables were homogeneous across the intervention and control groups. Therefore, the assumption of homogeneity of variance was satisfied, and the independent samples t-test could be appropriately applied for further analysis.

Effect of Digital Pocketbook on Health Literacy

Comparison of Health Literacy Scores Before and After Intervention

The comparison of health literacy scores before and after the intervention is presented in Table 4.

Table 4 Comparison of Health Literacy Scores Before and After Intervention

Group	Pretest Mean ± SD	Posttest Mean ± SD	Mean Difference	95% CI	p-value
Intervention	58.23 ± 8.45	82.67 ± 6.72	24.44	20.11–28.77	<0.001
Control	57.89 ± 8.17	63.21 ± 7.54	5.32	1.08–9.56	0.071

The findings indicate a clear educational advantage of the digital pocketbook intervention over conventional instruction. Students who received the digital pocketbook demonstrated substantial improvements in their ability to access, understand, and utilize health-related information, whereas only minimal changes were observed among students receiving traditional health education. The magnitude of improvement suggests that the digital pocketbook effectively facilitated meaningful learning experiences and supported the development of health literacy competencies among elementary school students. These results highlight the potential of digitally supported learning resources to strengthen students' understanding of health concepts beyond what is typically achieved through conventional classroom approaches.

The improvement in health literacy observed in the intervention group indicates that the use of the digital pocketbook effectively supported students in accessing, understanding, and utilizing health-related information. Digital learning media facilitate more engaging information delivery through the integration of text, illustrations, colors, and visual designs that are appropriate for the developmental characteristics of elementary school students (Rizkasari et al., 2026). These findings are consistent with previous studies reporting that digital learning media can enhance students' understanding of health concepts and improve health literacy among school-aged children (Rizkasari et al., 2026).

Furthermore, health literacy theory suggests that individuals' ability to understand and apply health information is influenced not only by the content itself but also by the manner in which the information is presented to learners (Pe et al., 2022). In the present study, the presentation of anemia prevention materials through a digital pocketbook provided students with more active, interactive, and self-directed learning experiences, thereby facilitating the development of health literacy more effectively. The findings also support the notion that well-designed digital educational resources can promote meaningful learning and encourage students to engage more actively with health-related content.

Effect of Digital Pocketbook on Anemia Prevention Awareness

Table 5 Comparison of Anemia Prevention Awareness Scores Before and After Intervention

Group	Pretest Mean ± SD	Posttest Mean ± SD	Mean Difference	95% CI	p-value
Intervention	56.74 ± 7.98	84.11 ± 6.33	27.37	22.84-31.90	<0.001
Control	55.91 ± 8.23	61.42 ± 7.88	5.51	0.92–10.10	0.084

The findings indicate that the digital pocketbook intervention was effective in strengthening students' awareness of anemia prevention compared with conventional health education. Students who received the intervention demonstrated a clear improvement in their understanding of preventive health practices, whereas only minimal changes were observed in the control group. This trend suggests that the digital pocketbook successfully promoted greater awareness of healthy behaviors and preventive actions related to anemia among elementary school students.

Table 5 shows a significant increase in anemia prevention awareness scores among students in the intervention group following the implementation of the digital

pocketbook intervention ($p < 0.001$). In contrast, no statistically significant change was observed in the control group ($p = 0.084$). Furthermore, the 95% confidence interval (22.84–31.90) indicates that the improvement in anemia prevention awareness was substantial and consistently observed among participants who received the intervention.

These findings suggest that digital learning media can enhance not only students' cognitive understanding but also their awareness of the importance of preventive health behaviors. Health awareness is considered a critical factor in the development of healthy lifestyles from an early age because it influences individuals' ability to recognize health risks and adopt appropriate preventive actions (Ben Yehuda et al., 2024). The significant improvement in anemia prevention awareness observed in this study indicates that increased access to understandable and engaging health information may contribute to the formation of positive health attitudes among elementary school students.

The effectiveness of the digital pocketbook in increasing awareness may be attributed to its interactive and visually appealing design. Educational materials related to anemia prevention were presented through attractive illustrations, examples of iron-rich foods, practical health messages, and age-appropriate explanations, enabling students to better understand the importance of healthy eating habits and preventive health practices. These findings are consistent with previous studies reporting that digital health education interventions can improve health awareness, motivation, and students' willingness to adopt healthy behaviors (Aji et al., 2026b).

From an educational perspective, the improvement in anemia prevention awareness demonstrates that digital learning resources can support affective learning outcomes in addition to cognitive achievement. This finding highlights the potential of digital pocketbooks as innovative instructional tools that not only increase knowledge acquisition but also foster positive attitudes and awareness related to health promotion among elementary school students.

Effect Size Analysis

To determine the practical significance of the intervention, Cohen's d effect size analysis was conducted. The results are presented in Table 6.

Table 6 Effect Size of the Digital Pocketbook Intervention

Variable	Cohen's d	Interpretation
Health Literacy	1.85	Large Effect
Anemia Prevention Awareness	1.92	Large Effect

Based on Cohen's (1988) criteria, effect size values of 0.20, 0.50, and 0.80 represent small, medium, and large effects, respectively. The findings showed that the digital pocketbook intervention produced a large effect on both health literacy (d = 1.85) and anemia prevention awareness (d = 1.92). These results indicate that the intervention not only achieved statistical significance but also generated substantial educational benefits for elementary school students. Therefore, the digital pocketbook can be considered an effective learning medium for improving students' understanding of health information and increasing awareness regarding anemia prevention.

Comparison Between Intervention and Control Groups

The comparison of posttest scores between the intervention and control groups is presented in Table 7.

Table 7 Independent Samples t-test of Posttest Scores

Variable	Intervention Mean ± SD	Control Mean ± SD	Mean Difference	p-value
Health Literacy	82.67 ± 6.72	63.21 ± 7.54	19.46	<0.001
Anemia Prevention Awareness	84.11 ± 6.33	61.42 ± 7.88	22.69	<0.001

The independent samples t-test revealed significant differences between the intervention and control groups in both health literacy and anemia prevention awareness following the intervention ($p < 0.001$).

The posttest comparison demonstrated that students in the intervention group achieved substantially higher scores in both health literacy and anemia prevention awareness than those in the control group. These findings suggest that the digital pocketbook was more effective than conventional instructional methods in facilitating students' understanding of health information and promoting awareness regarding anemia prevention. The magnitude of the differences further supports the educational value of integrating digital learning media into elementary school health education.

Discussion

The findings of this study revealed that the use of a digital pocketbook significantly improved students' health literacy and anemia prevention awareness.

Moreover, the large effect sizes observed for both health literacy (d = 1.85) and anemia prevention awareness (d = 1.92) indicate that the intervention generated substantial educational benefits beyond statistical significance. These findings suggest that the digital pocketbook was not only effective in producing measurable learning gains but also demonstrated meaningful practical value for elementary school health education. The results support constructivist learning theory, which posits that learners achieve deeper understanding when they actively construct knowledge through interaction with meaningful and engaging learning resources (Liu et al., 2022).

The observed increase in anemia prevention awareness may be closely related to the improvement in students' health literacy. Health literacy enables individuals to access, understand, evaluate, and apply health-related information in ways that support informed decision-making. In the context of this study, students who developed a better understanding of anemia, its risk factors, symptoms, consequences, and prevention strategies were more likely to recognize the importance of preventive health practices. As students became more capable of interpreting health information presented through the Digital Pocketbook, their awareness of anemia prevention also increased. This finding supports health literacy theory, which suggests that greater understanding of health information serves as an important foundation for developing preventive health awareness and positive health-related attitudes.

The effectiveness of the digital pocketbook may also be explained by increased learning engagement. Interactive learning materials, attractive visual designs, concise explanations, and flexible access to educational content may encourage students to participate more actively in the learning process. Higher levels of engagement have consistently been associated with improved comprehension, knowledge retention, and educational outcomes in technology-enhanced learning environments (Al-mamary & Abdulrab, 2023). In the present study, the digital pocketbook provided students with opportunities to explore educational content independently, thereby fostering greater involvement in learning activities and enhancing their overall learning experience (Yakavets et al., 2023).

The significant improvements observed in this study may further be attributed to the learner-friendly characteristics of the digital pocketbook. Unlike conventional learning materials, the digital pocketbook integrates visual elements, structured information, and age-appropriate content that facilitate information processing among

elementary school students. These features may enhance students' cognitive engagement and motivation to learn, thereby improving their ability to comprehend and retain health-related information. From a constructivist perspective, meaningful learning occurs when learners actively interact with educational content and connect new knowledge with prior experiences, which may explain the substantial improvements observed in both outcome variables (Piaget, 2022).

The improvement in health literacy demonstrated in this study suggests that digital pocketbooks can serve as an effective alternative medium for health education in elementary schools. The integration of digital technology into learning environments enables students to access educational resources more flexibly and independently, thereby supporting the development of critical thinking skills and informed health-related decision-making (Zebua, 2025). These findings are consistent with previous studies reporting that interactive digital learning media can significantly enhance health literacy among school-aged children (Ben Yehuda et al., 2024). Furthermore, health literacy theory emphasizes that individuals' ability to understand and apply health information is influenced not only by the content itself but also by the way the information is communicated and presented to learners (Vaz de Almeida, 2021).

A notable contribution of this study is its examination of both health literacy and anemia prevention awareness as complementary educational outcomes. While previous studies have primarily focused on improving health knowledge through digital learning media, this study extends the existing literature by demonstrating that digital pocketbooks can simultaneously enhance students' understanding of health information and their awareness of preventive health behaviors within an elementary school context. This integrated approach contributes to the growing body of research on health education and digital learning in primary education settings (Rizkasari et al., 2023).

In addition to improving health literacy, the intervention significantly increased students' anemia prevention awareness. These findings suggest that enhanced understanding of health information may contribute to the development of preventive health awareness among young learners. According to the (World Health Organization, 2024b), health education delivered during childhood is a critical strategy for fostering sustainable healthy behaviors throughout life. Therefore, the use of digital pocketbooks may represent an innovative educational approach to support school-based health

promotion programs and strengthen preventive health education among elementary school students (Dumbi & Indrasari, 2024).

From an educational perspective, this study contributes to the development of technology-based learning media that can assist teachers in integrating health-related content into classroom instruction. The digital pocketbook supports student-centered learning by encouraging active participation, independent learning, and greater engagement with educational materials. These outcomes are aligned with the principles of the Merdeka Curriculum, which emphasizes learner autonomy, meaningful learning experiences, and the development of lifelong competencies (Nurmaya et al., 2026).

Educational Implications

The findings of this study have several practical implications for elementary school teachers. First, Digital Pocketbooks may serve as supplementary learning resources that support the delivery of health education in a more engaging and accessible manner. Teachers can integrate Digital Pocketbooks into classroom activities, thematic learning sessions, or school health programs to reinforce concepts related to nutrition, healthy lifestyles, and disease prevention. Second, the use of visual illustrations, concise learning modules, and interactive activities may help teachers present health-related content in ways that are more appropriate to the cognitive and developmental characteristics of elementary school students. Third, Digital Pocketbooks can facilitate independent learning by enabling students to access educational materials both inside and outside the classroom, thereby extending learning opportunities beyond scheduled instructional time. Finally, the findings suggest that teachers may play an important role in maximizing the effectiveness of digital learning media through guided discussions, reflective activities, and continuous reinforcement of key health messages. Therefore, integrating Digital Pocketbooks into elementary education may contribute to more meaningful and student-centered health learning experiences.

Policy Implications

The results of this study support the integration of digital health education resources into elementary school learning programs. Educational policymakers, school administrators, and teachers may consider incorporating digital pocketbooks as supplementary educational materials to strengthen health literacy and preventive health awareness among students. Such initiatives may contribute to broader school-based

health promotion efforts and support national strategies aimed at improving children's health outcomes through educational interventions.

Strengths of the Study

A major strength of this study is its integration of digital learning media with health education in an elementary school setting, an area that remains relatively underexplored in Indonesian educational research. Unlike previous studies that focused primarily on knowledge acquisition, this study simultaneously examined health literacy and anemia prevention awareness as educational outcomes. Furthermore, the use of a quasi-experimental design with a control group strengthened the internal validity of the findings and provided more robust evidence regarding the effectiveness of the intervention. The inclusion of effect size analysis and confidence interval estimation further enhanced the rigor and practical significance of the study results.

Limitations and Future Research

Despite its contributions, this study has several limitations. First, the study was conducted in only one elementary school, which may limit the generalizability of the findings to other educational contexts. Second, the relatively short intervention period did not allow for the assessment of long-term behavioral changes related to anemia prevention. Third, the study relied primarily on self-reported questionnaire data, which may be subject to response bias and social desirability effects. Finally, the study measured health literacy and awareness but did not evaluate actual behavioral changes related to anemia prevention practices. Therefore, future studies are recommended to involve larger and more diverse samples, implement longer intervention periods, and assess behavioral outcomes to provide a more comprehensive understanding of the effectiveness of digital learning media in supporting health promotion and preventive education among elementary school students.

Taken together, the findings indicate that digital pocketbooks represent a promising educational innovation for integrating health promotion into elementary school learning. By combining accessible digital content with student-centered learning principles, digital pocketbooks may contribute to the development of both cognitive and affective learning outcomes related to health education.

Conclusion

The findings demonstrate that digital pocketbook-based learning is an effective approach for improving health literacy and anemia prevention awareness among elementary school students. The study highlights the potential of digital pocketbooks as an innovative educational medium that can support school-based health promotion and strengthen students' understanding of preventive health practices from an early age. These results support the integration of technology-enhanced learning resources into elementary education to facilitate more engaging and meaningful health learning experiences. Future research should examine the long-term effects of digital pocketbook interventions across diverse educational settings and populations.

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