

Evaluating a Safe Internet Education Program to Enhance Elementary Students' Digital Literacy in Palarahi

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ABSTRACT

The rapid increase in internet use among elementary students has not been matched by adequate digital literacy, exposing them to risks such as cyberbullying, disinformation, and misuse of personal data. This study examined the effectiveness of the Safe Internet Education Program in enhancing students' digital literacy in Palarahi Village, Southeast Sulawesi. Using a quasi-experimental one-group pre-test and post-test design, the program was implemented through eight interactive sessions involving 85 students from two public elementary schools. The results showed a significant improvement in digital literacy scores, increasing from a mean of 52.3 to 78.6 ($p < 0.001$) with a large effect size (Cohen's $d = 2.31$). The proportion of students in the high literacy category rose from 4.7% to 85.9%, while those in the low category dropped to 0%. The greatest improvement occurred in personal data security, followed by information evaluation and digital communication. The study concludes that structured and participatory digital education can effectively strengthen children's competence and online safety. This model offers a measurable framework to support the implementation of the National Digital Literacy Movement (#Siberkreasi) in rural and non-metropolitan areas.

Keywords: Cyber Safety; Digital Ethics; Digital Literacy; Education Program; Safe Internet.

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1. Introduction

Children's increasing internet access exposes them to significant psychosocial risks such as cyberbullying, disinformation, and the erosion of empathy. Prior studies in Indonesia have highlighted these challenges, yet only a few have developed structured, quantitative interventions to strengthen preventive digital literacy among students. In response to this issue, this study aligns with the National Digital Literacy Movement (#Siberkreasi) by offering a measurable framework to enhance digital competence and online ethics among elementary school learners.

Recognizing the urgency of digital literacy education, the Government of Indonesia, through the Ministry of Communication and Digital Affairs (Komdigi), launched the National Digital Literacy Movement (#Siberkreasi). This program seeks to strengthen digital literacy capacity across Indonesian society, promoting safe, creative, and responsible technology use (Yuliantini & Suswanta, 2024). GNLD #Siberkreasi mobilizes a wide range of stakeholders, including government institutions, community organizations, academic bodies, and private sector partners, to deliver digital literacy programs nationwide. The program emphasizes four key learning domains: digital skills, digital ethics, digital safety, and digital culture (Banyu Hikmah et al., 2024). By situating this community service activity

within the GNLD framework, this study not only addresses local digital challenges but also contributes to achieving the national agenda for digital empowerment (Alkhairi et al., 2025).

The theoretical foundation of this educational program is the concept of digital citizenship, which refers to the ethical and responsible use of technology in online interactions (Mahadir et al., 2021). Digital citizenship extends beyond technical literacy by integrating ethical, critical, and participatory knowledge in digital environments (Febrina et al., 2024). This study adopts Ribble's (2021) digital citizenship framework, which outlines nine components such as digital access, digital literacy, digital etiquette, digital law, digital security, and digital health and wellness. From this framework, five constructs are operationalized as the basis for program measurement: personal data security, digital ethics, information evaluation, digital communication, and digital time management (Capuno et al., 2022).

Palarahi Village in Wawotobi District, Konawe Regency, Southeast Sulawesi, mirrors the broader national situation but on a smaller scale. Initial observations and surveys revealed that 89 percent of elementary students in the area have access to the internet, yet most lack sufficient literacy to use it safely (Nurfadilah & Effendy, 2025). Approximately 72 percent use the internet without adult supervision, 68 percent are unaware of how to protect personal information, and 85 percent do not fully understand cyberbullying or its consequences (Salsabila & Rukli, 2025; Hafidhi, Hanafi, Hadi, Suyitno, & Anggraini, 2024). These findings underscore the urgent need for educational interventions targeting the safe and ethical use of digital platforms.

Previous research in Indonesia has extensively explored digital literacy in elementary education but has been dominated by descriptive or qualitative approaches that only describe perceptions or teaching practices (Sembiring, 2024). A notable gap remains in the form of quantitative intervention studies that employ measurable pre-test and post-test designs, are grounded in comprehensive frameworks such as digital citizenship, demonstrate significant effect sizes, and are conducted in rural or non-metropolitan settings where access and resources are limited (Jones, Mitchell, & Beseler, 2024; Buchan, Bhawra, & Katapally, 2024). Addressing this gap, the present study aims to examine the effectiveness of a structured Safe Internet Education Program in improving the digital literacy skills of elementary school students in Palarahi Village. It is hypothesized that participation in the program will significantly enhance students' digital literacy scores compared to baseline measurements.

2. Method

This community service activity was developed through a quantitative research approach with a quasi-experimental type using a one-group pretest and post-test design (Creswell, 2014). The result was an experimental design that enabled us to objectively measure the effects of the intervention in terms of pre- and post-digital literacy levels (Neuman, 2014). The actions were spread over six weeks beginning in early February and ending in mid-March of 2025. The intervention was conducted in two public elementary schools, namely SDN 1 Palarahi and SDN 2 Palarahi Village, Wawotobi Districts in Konawe Regency, Southeast Sulawesi.

2.1 Participants and Sampling Procedure

The population of this study consisted of all students in grades 4, 5, and 6 at SDN 1 and SDN 2 Palarahi, totaling 95 students who were the intended participants. The method used in sampling was total sampling; all populations were involved as program participants.

Inclusion criteria were that (1) students had enrolled in grades 4, 5, or 6; (2) written informed consent was provided by the parent/caregiver; and (3) students attended at least 80% of the eight educational sessions. Ninety-five population-based students were included and studied, making it 85 after meeting all inclusion criteria, and that was the final sample size of the study (45 students in SDN 1 Palarahi and 40 students from SDN 2 Palarahi).

2.2 Digital Literacy Measurement Instrument

The instrument used to measure digital literacy was a structured questionnaire comprising 40 items distributed across five domains: (1) Personal Data Security (8 items), (2) Information Evaluation (8 items), (3) Digital Communication (8 items), (4) Digital Ethics (8 items), and (5) Digital Time Management (8 items). Each item employed a 4-point Likert scale response format (1 = strongly disagree to 4 = strongly agree). Scoring was computed by summing correct responses, with a maximum score of 16 per domain and a total maximum score of 80. Final scores were reported as means, which may exceed the maximum in cases where rounding is applied.

To support the quality of the instrument, validity and reliability tests were carried out. Face validity was investigated with the help of expert opinion from three faculty members of educational technology, and content validity checks were also performed by them that resulted in a CVI (Content Validity Index) of 0.89, showing very acceptable validity. Internal reliability testing with Cronbach's Alpha yielded a coefficient of 0.92, which signifies a very high internal consistency of the tool.

2.3 Intervention Model: Safe Internet Education Program

The intervention implemented was the Safe Internet Education Program, conducted intensively over a four-week period with a total of eight sessions. Each session lasted approximately 60 minutes and was held outside regular school hours. The primary method employed was community education through interactive and participatory learning activities designed to suit children's learning characteristics. The program content was systematically structured to cover all domains of measured digital literacy, including personal data security, information evaluation, digital communication, digital ethics, and digital time management.

To provide a clearer overview, the topics, objectives, methods, and duration of each session are summarized in the following table:

Table 1. Summary of the Safe Internet Education Program Sessions

Session	Topic	Objective	Learning Method	Duration
1	Introduction to the Internet and Its Benefits	To build students' understanding of the positive uses of the internet and its role in education and creativity.	Interactive lecture and guided discussion	60 minutes
2	Online Risks and Safe Internet Behavior	To identify potential online dangers such as cyberbullying, hoaxes, and harmful content, and to promote safe browsing habits.	Case study and group discussion	60 minutes
3	Protection of Personal Data	To explain the importance of privacy, password	Demonstration and interactive quiz	60 minutes

	and Digital Footprint (Part 1)	security, and personal data protection.		
4	Protection of Personal Data and Digital Footprint (Part 2)	To strengthen students' awareness of digital footprints and responsible information sharing.	Role-playing and reflection	60 minutes
5	Digital Ethics and Communication (Part 1)	To develop students' understanding of netiquette and respectful communication in digital environments.	Group simulation and storytelling	60 minutes
6	Digital Ethics and Communication (Part 2)	To practice empathy and responsible social interaction in online communication.	Case analysis and peer feedback	60 minutes
7	Digital Time Management	To promote balanced technology use and prevent excessive screen time.	Discussion and time-planning activity	60 minutes
8	Reporting Mechanisms and Evaluation	To train students on how to report online incidents and evaluate what they have learned throughout the program.	Reflection session and post-program evaluation	60 minutes

Each session was facilitated by two instructors with educational and information technology backgrounds to ensure effective and engaging delivery. The pedagogical approach integrated multiple methods, including interactive lectures, group discussions, role-playing to simulate cyberbullying cases, simple case studies, and the use of visual learning media such as multimedia presentations, educational videos, and interactive posters. This structured and participatory approach was designed to improve both cognitive understanding and practical digital safety skills among elementary students.

2.4 Data Collection and Analysis Procedure

Data were obtained in two parts. The pre-test was conducted a week before the opening of the first session of the program to examine students' initial digital literacy level. The post-test was given two weeks after the last session so that information retention and knowledge increase could be measured. The questionnaires used in both tests were the same, and they were filled out during a class period conducted by the support team, since this control allowed for objectivity and validity of responses.

Data analysis was conducted using the Statistical Package for Social Sciences (SPSS) program, version 25.0. The data were processed as follows: Descriptive analysis: Performed to report demographic profiles of the sample and distribution of digital literacy scores (mean, standard deviation). Normality Test: The Shapiro-Wilk test was used to check for data distribution. Inspection of the difference scores revealed a normal distribution ($p > 0.05$). Inferential Analysis: Because the distribution of the data was normal, a paired samples t-test was used to test the hypothesis that there would be a significant difference between pre-test and post-test average scores. Effect Size: To assess the size of the intervention effect, Cohen's d was computed. A two-tailed level of significance (α) for all hypothesis tests was predetermined at 0.05.

2.5 Ethical Considerations

Written informed consent was obtained from all study participants, and ethical approval for the research and community service activities was provided by the Research Ethics Committee of XXX 045/UN29.20/PPM/2025. Before starting, the parents or legal guardians of the participating students provided signed informed consent. The ethical considerations, such as the maintaining of privacy and anonymity for the respondents' data, informed consent (or willingness to participate), and the principle of doing no harm, were all adhered to both in this study as well as in all phases of application.

3. Result

3.1 Descriptive Statistics of Participants

A total of 85 students from SDN 1 Palarahi (n=45) and SDN 2 Palarahi (n=40) completed the intervention program and met all inclusion criteria. The demographic distribution of participants is presented in Table 1.

Table 1. Demographic Characteristics of Participants (n=85)

Characteristic	Category	n	Percentage (%)
Gender	Male	45	52.9
	Female	40	47.1
Grade Level	Grade 4	27	31.8
	Grade 5	30	25.3
	Grade 6	28	32.9
Home Internet Access	Yes	65	76.5
	No	20	23.5
School	SDN 1 Palarahi	45	52.9
	SDN 2 Palarahi	40	47.1

Source: Primary Data Processed, 2025

The sample consisted of relatively balanced gender representation, with male students comprising 52.9% and female students 47.1%. Grade distribution was relatively even across grades 4-6. Most students (76.5%) reported having internet access at home, while 23.5% did not have home internet access.

3.2 Comparison of Pre-test and Post-test Digital Literacy Scores

Table 2 presents the comparative analysis of digital literacy scores before and after the Safe Internet Education Program intervention across all measured domains.

Table 2. Comparison of Pre-test and Post-test Digital Literacy Scores (n=85)

Digital Literacy Domain	Pre-test (Mean \pm SD)	Post-test (Mean \pm SD)	Difference	Improvement (%)	p-value
Personal Data Security	8,6 \pm 2,3	13,3 \pm 1,8	4,7	54,7	<0,001
Information Evaluation	9,4 \pm 2,8	13,8 \pm 2,1	4,4	46,8	<0,001
Digital Communication	11,2 \pm 3,1	15,9 \pm 2,4	4,7	42,0	<0,001
Digital Ethics	10,8 \pm 2,6	15,0 \pm 2,2	4,2	38,9	<0,001

Digital Time Management	12,3±2,9	16,2±2,6	3,9	31,7	<0,001
Total Score	52,3±12,4	78,6±9,8	26,3	50,3	<0,001

**Note: Maximum score per domain = 16; maximum total score = 80. Source: Primary Data Processed, 2025*

Figure 1 illustrates the comparison of mean scores across all digital literacy domains between pre-test and post-test measurements, visually demonstrating the substantial improvements achieved through the intervention.

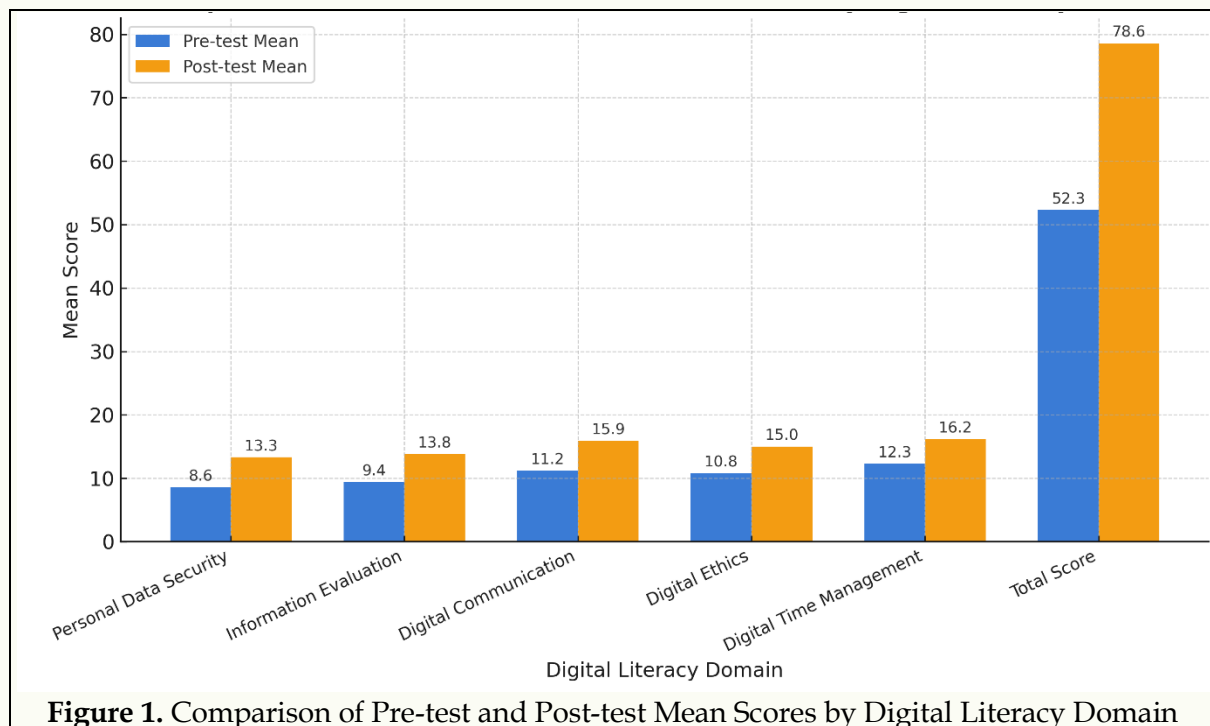


Figure 1. Comparison of Pre-test and Post-test Mean Scores by Digital Literacy Domain

Source: Primary Data Processed, 2025

The overall digital literacy score increased significantly from a mean of 52.3 (SD = 12.4) at pre-test to 78.6 (SD = 9.8) at post-test, representing a raw score difference of 26.3 points or a 50.3% relative improvement from baseline. A paired-samples t-test revealed this difference to be highly statistically significant [$t(84) = 18.42$, $p < 0.001$]. The effect size for the intervention was calculated using Cohen's d , yielding a value of 2.31. According to conventional interpretation guidelines, this represents an exceptionally large effect size, substantially exceeding the threshold of $d = 0.8$ typically considered "large" in behavioral intervention research.

All five domains demonstrated statistically significant improvements ($p < 0.001$). The rank order of percentage improvement was: Personal Data Security (54.7%), Information Evaluation (46.8%), Digital Communication (42.0%), Digital Ethics (38.9%), and Digital Time Management (31.7%).

3.3 Distribution of Digital Literacy Proficiency Categories

Table 3 illustrates the categorical distribution of students' digital literacy proficiency levels before and after the intervention.

Table 3. Distribution of Digital Literacy Proficiency Categories (n=85)

Digital Literacy Category	Pre-test (n, %)	Post-test (n, %)	Change (n, %)
Low (≤ 60)	57 (67.1%)	0 (0%)	-57 (-67.1%)
Moderate (61–75)	24 (28.2%)	12 (14.1%)	-12 (-14.1%)
High (≥ 76)	4 (4.7%)	73 (85.9%)	+69 (+81.2%)
Total	85 (100%)	85 (100%)	

Source: Primary Data Processed, 2025

At pre-test, most students (67.1%) demonstrated low digital literacy proficiency, with only 4.7% classified in the high proficiency category. Following the intervention, a dramatic redistribution occurred: no students remained in the low category, while the high proficiency category increased to encompass 85.9% of participants. The moderate proficiency category decreased from 28.2% to 14.1%.

3.4 Analysis of Score Improvements by Demographic Characteristics

Table 4 presents the analysis of digital literacy score improvements disaggregated by demographic characteristics to identify potential moderating factors.

Table 4. Score Improvements by Demographic Characteristics (n=85)

Characteristic	Category	n	Score Improvement (Mean \pm SD)	p-value
Gender	Male	45	25.8 \pm 7.2	0.234
	Female	40	26.9 \pm 6.8	
Grade Level	Grade 4	27	22.1 \pm 6.4	0.012*
	Grade 5	30	26.8 \pm 7.1	
	Grade 6	28	30.2 \pm 6.9	
Home Internet Access	Yes	65	27.4 \pm 6.8	0.031*
	No	20	22.6 \pm 7.4	
School	SDN 1 Palarahi	45	26.1 \pm 7.0	0.678
	SDN 2 Palarahi	40	26.5 \pm 7.2	

Note: $p < 0.05$ indicates statistically significant differences. Analysis conducted using independent samples *t*-test (gender, home internet access, school) and one-way ANOVA with post-hoc Tukey test (grade level)

Source: Primary Data Processed, 2025

a. Gender Differences

No statistically significant difference in score improvement was observed between male students ($M = 25.8$, $SD = 7.2$) and female students ($M = 26.9$, $SD = 6.8$), $t(83) = -0.72$, $p = 0.234$. Both groups demonstrated comparable gains from the intervention.

b. Grade Level Differences

Significant differences in score improvement were found across grade levels, $F(2, 82) = 8.94$, $p = 0.012$. Post-hoc Tukey tests revealed that sixth graders ($M = 30.2$, $SD = 6.9$) showed significantly greater improvement than fourth graders ($M = 22.1$, $SD = 6.4$, $p = 0.008$), with fifth graders ($M = 26.8$, $SD = 7.1$) demonstrating intermediate gains that differed significantly from fourth graders ($p = 0.041$) but not from sixth graders ($p = 0.187$).

c. Home Internet Access Differences

Students with home internet access ($M = 27.4$, $SD = 6.8$) demonstrated significantly greater score improvement compared to students without home internet access ($M = 22.6$, $SD = 7.4$), $t(83) = 2.67$, $p = 0.031$. The mean difference of 4.8 points represents a moderate but statistically significant effect of prior digital exposure.

d. School Location Differences

No significant difference in score improvement was observed between students from SDN 1 Palarahi ($M = 26.1$, $SD = 7.0$) and SDN 2 Palarahi ($M = 26.5$, $SD = 7.2$), $t(83) = -0.26$, $p = 0.678$, indicating consistent program effectiveness across both school sites.

4. Discussion

4.1 Program Effectiveness and Digital Citizenship Framework

The findings of this study demonstrate that the Safe Internet Education Program produced a substantial and statistically significant improvement in elementary students' digital literacy competencies. The 50.3% increase in mean scores, coupled with an effect size of Cohen's $d = 2.31$, represents an exceptionally large intervention impact that extends beyond mere statistical significance to practical educational relevance. This outcome provides empirical validation for Ribble (2021) Digital Citizenship framework as an effective organizing structure for developing digital literacy interventions in elementary education contexts.

The magnitude of change observed in this study surpasses findings reported in comparable intervention research. For instance, Jones et al. (2024) documented moderate effect sizes ($d = 0.65$) in their digital safety program for rural youth, while Buchan et al. (2024) reported improvements of approximately 35% in digital literacy scores among school-aged children following structured interventions. The superior outcomes in this study may be explained by several design features. The program offered an intensive eight-session format that reinforced concepts through repeated exposure. It also used a participatory learning approach consistent with constructivist principles and supported by findings from Melina (2025). In addition, the intervention covered all major digital citizenship dimensions, which encouraged holistic competence development instead of isolated skills.

The dramatic categorical shift, from 67.1% of students in the "low" literacy category at baseline to 85.9% achieving "high" literacy post-intervention, represents a fundamental transformation in competency distribution rather than incremental improvement. This pattern suggests that the program successfully addressed critical knowledge gaps that had previously prevented students from reaching functional digital literacy thresholds. Such findings align with Vygotsky's concept of the Zone of Proximal Development, wherein structured educational scaffolding enables learners to bridge the gap between current and potential competency levels (Capuno et al., 2022). The intervention appears to have provided the guided instruction necessary to move students from assisted to independent performance in digital contexts.

4.2 Domain-Specific Improvements and Theoretical Implications

The differential gains across digital literacy domains reveal important insights into the nature of digital competency development. The Personal Data Security domain exhibited the highest percentage improvement (54.7%), suggesting that concrete, rule-based knowledge about digital safety is highly responsive to short-term educational intervention. This finding resonates with Mahzunah et al. (2024) who observed that Indonesian elementary students

demonstrate critical gaps in understanding personal data protection and often share information without recognizing associated risks. The low baseline score (8.6 out of 16) in this domain indicates that students possessed minimal prior knowledge about fundamental security practices, which created a strong foundation for substantial improvement when explicit instruction was provided.

From a cognitive development perspective, Personal Data Security concepts are relatively concrete and procedural in nature, for example instructions such as “do not share your location” or “create strong passwords.” These concepts are accessible to elementary-aged children who are still within Piaget’s concrete operational stage. The instructional approach, which emphasized tangible rules, visual demonstrations, and concrete examples, aligned well with students’ developmental capacities. This alignment likely facilitated rapid knowledge acquisition and retention, as reflected in the substantial post-test scores (13.3 out of 16).

In contrast, Digital Time Management showed the smallest percentage increase (31.7%), although the improvement remained statistically significant. This finding requires careful interpretation through the lens of health behavior change theory. Digital time management involves not only cognitive understanding but also self-regulation, habit formation, and behavioral control. These competencies develop gradually and depend on sustained environmental support (Wardani & Putri, 2025). Kalkim and Emlek Sert (2021) similarly found that knowledge about healthy technology use does not automatically translate into behavioral change among young people, particularly when environmental factors such as peer influence, device availability, and parental modeling reinforce existing patterns. This aligns with Sogen (2025), who emphasized that children’s digital habits in rural communities are strongly shaped by family involvement and local parenting practices.

The Information Evaluation domain also demonstrated a substantial improvement (46.8%), which is particularly relevant in today’s digital landscape marked by widespread misinformation and disinformation. The program’s success in strengthening critical evaluation skills aligns with findings by Febrina et al. (2024), who emphasized that young people’s ability to distinguish credible from non-credible online content serves as an essential protective factor against manipulation. The case study method used in this intervention, where students analyzed real examples of hoaxes, misleading headlines, and manipulated images, appears to have effectively stimulated the development of evaluative reasoning skills. This pedagogical approach operationalizes the critical thinking dimension of digital citizenship by shifting students from passive information consumption toward active cognitive engagement with digital content.

4.3 Moderating Factors and Educational Equity Considerations

The analysis of demographic moderators revealed two significant patterns worthy of theoretical consideration. First, the absence of gender differences in program effectiveness ($p = 0.234$) contradicts some earlier research suggesting differential digital literacy development trajectories between boys and girls. This finding may reflect the intervention’s gender-inclusive design, which deliberately incorporated diverse examples, avoided gender-stereotyped content, and employed mixed-gender collaborative learning activities. The result aligns with contemporary perspectives on digital competencies as universally learnable skills rather than gender-differentiated aptitudes (Yuliantini & Suswanta, 2024).

The significant grade-level differences observed ($p = 0.012$), with sixth graders showing greater improvement than fourth graders, invite interpretation through developmental psychology frameworks. Piaget’s theory of cognitive development suggests that children

transitioning from concrete to formal operational thinking (typically ages 11-12) develop enhanced capacity for abstract reasoning, hypothetical thinking, and systematic problem-solving. Concepts such as "digital footprint," "online reputation," and "long-term privacy consequences" require abstract thinking abilities that may be emerging but not fully developed in younger elementary students. This finding has important implications for curriculum differentiation: digital literacy education for lower elementary grades may require more concrete, experience-based approaches with simplified conceptual frameworks, whereas upper elementary students can engage with more complex, abstract dimensions of digital citizenship.

The significant difference based on home internet access ($p = 0.031$) highlights the role of prior experiential learning in shaping students' digital literacy development. Students who had internet access at home ($M = 27.4$, $SD = 6.8$) demonstrated greater improvement compared to those without home access ($M = 22.6$, $SD = 7.4$). The mean difference of 4.8 points indicates a moderate yet meaningful effect of prior digital exposure. This pattern reflects broader challenges observed in rural education systems. Hermanto et al. (2022) found that elementary school students in rural Indonesia face substantial barriers in digital learning, including limited device ownership, unstable connectivity, and minimal opportunities to practice digital skills. Safiah et al. (2023) also reported that students from rural domiciles experience significant disadvantages in online learning due to weaker technological access and limited digital engagement at home.

These findings raise important equity considerations that align with wider literature on digital divides in Indonesia. Students without access to digital tools and stable internet at home accumulate disadvantages over time, including reduced technical skill development and lower familiarity with digital environments. While the current intervention successfully improved digital literacy among all participants, the persistent gap between students with and without home internet access suggests that educational programs alone cannot fully address structural inequalities. This reinforces the need for comprehensive digital inclusion policies that integrate infrastructure expansion, community-based digital support, and literacy development simultaneously (Saputra et al., 2023; Alkhairi et al., 2025).



Figure 2. Community service team delivering a Digital Literacy and Safe Internet session to elementary school students in Palarahi Village, Konawe, 2025.

4.4 Practical Contributions to National Digital Literacy Policy

This study makes a significant contribution to the operationalization of Indonesia's National Digital Literacy Movement (#Siberkreasi) by providing empirical evidence of program effectiveness at the grassroots level. The GNLD #Siberkreasi initiative, while ambitious in scope and vision, has encountered implementation challenges, particularly in non-metropolitan regions where resources, trained personnel, and institutional support structures are limited (Banyu Hikmah et al., 2024). The current study demonstrates that substantial literacy gains are achievable in rural elementary school contexts when the curriculum is designed systematically, grounded in established theoretical frameworks such as Digital Citizenship, and supported by participatory pedagogy and modest resource investment.

The program model tested in this research offers a replicable blueprint that responds to several implementation barriers identified in evaluations of national digital literacy initiatives. The structured eight-session format provides clear sequencing and progressive skill development, reducing dependence on facilitator improvisation. The use of multiple pedagogical methods, including interactive lectures, role-playing, case studies, and visual media, accommodates diverse learning styles and maintains student engagement, which is essential in resource-constrained settings. In addition, the explicit translation of abstract digital citizenship principles into concrete and measurable competencies, such as personal data security and information evaluation, enables systematic instruction and objective assessment of learning outcomes.

The community-based delivery model used in this study, which involved collaboration between university researchers and local schools, represents a scalable approach for expanding national policy implementation into underserved areas. This collaborative model aligns with Yuliana (2022), who emphasizes the importance of multi-stakeholder partnerships in digital literacy education, integrating academic expertise, institutional support, and community engagement to enhance both program quality and contextual relevance.

4.5 Limitations and Future Direction

While this study demonstrates substantial intervention effectiveness, several methodological limitations warrant acknowledgment. The absence of a control group in the quasi-experimental design limits the ability to attribute observed changes exclusively to the intervention, as maturation, testing effects, or external events could have contributed to improvements. Additionally, the geographic scope was limited to two elementary schools within a single village in Konawe Regency, constraining the generalizability of findings to broader populations with different socio-cultural contexts, internet infrastructure, and school resources. The relatively short follow-up period (two weeks post-intervention) also means that the sustainability of knowledge gains and behavioral changes remains unknown, particularly for competencies requiring extended behavioral self-regulation. Furthermore, the study relied on self-reported questionnaire responses rather than objective behavioral measures or authentic performance assessments, which may limit ecological validity.

Despite these limitations, the current study provides valuable preliminary evidence supporting the effectiveness of structured, theory-based digital literacy interventions in rural elementary education contexts. Future research should address these methodological constraints by employing randomized controlled trial designs with comparison groups, conducting replication studies across diverse geographic and socioeconomic contexts, implementing longitudinal follow-up assessments at 3-month, 6-month, and 12-month

intervals, and incorporating objective behavioral measures such as direct observations, parent/teacher reports, or scenario-based performance tasks. Such advances will strengthen both theoretical understanding and practical implementation of digital citizenship education in Indonesia and similar developing contexts.



Figure 3. Students with the community service team during the Digital Literacy and Safe Internet Program, Konawe, 2025.

5. Conclusion

The findings of this study confirm that the Safe Internet Education Program was highly effective in improving the digital literacy competence of elementary school students in Palarahi Village. The average digital literacy score increased from 52.3 in the pre-test to 78.6 in the post-test, with a large effect size (Cohen's $d = 2.31$). The proportion of students in the low literacy category decreased from 67.1% to 0%, while those in the high category rose sharply to 85.9%. The greatest improvement was observed in the Personal Data Security domain (54.7%), showing that practical and concrete instruction is highly effective for younger learners. Meanwhile, the smallest improvement in Digital Time Management (31.7%) indicates that behavioral change requires longer-term reinforcement and parental involvement.

The program's success was supported by its interactive and participatory learning methods, contextual materials based on the Digital Citizenship framework, and its structured eight-session design. These factors not only enhanced students' cognitive understanding but also built responsible and ethical digital habits. Beyond its local outcomes, this model serves as a practical reference for implementing the National Digital Literacy Movement (#Siberkreasi) in non-metropolitan areas where resources are limited.

Future initiatives should include longitudinal studies to evaluate the sustainability of learning outcomes over time, as well as program replication in other regions to test adaptability. Collaboration with local education authorities and community organizations will be essential to embed digital literacy within formal and informal learning systems. Additionally, integrating digital tools such as mobile applications and web-based modules can enhance accessibility, continuity, and scalability. Through these collective efforts, Indonesia can move closer to developing a sustainable digital literacy ecosystem that protects and empowers children in the digital age.

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