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Enhancing Digital Literacy in Local Communities Through Technology-Based Training

Rizky Mahendra Putra [1*], Daniel K. Osei [2]

[1] Department of Information Systems, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia

[2] Department of Information Science, University of Ghana, Accra, Ghana

*Corresponding Author: rizky.putra@uny.ac.id

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Abstract

Digital literacy has become a critical requirement for social inclusion, economic participation, and access to public services. Local communities, particularly in rural and semi-urban areas, continue to experience significant digital skill gaps. This study aims to analyze the effectiveness of technology-based training programs in enhancing digital literacy in local communities. The research employed a systematic literature-based empirical analysis of community service and intervention studies published between 2014 and 2025. Data were drawn from national and international peer-reviewed journals focusing on digital literacy training, community empowerment, and technology adoption. The findings indicate that structured training programs significantly improve digital competencies, including basic computer skills, internet usage, digital security awareness, and e-commerce engagement. Programs that integrate participatory learning, cultural relevance, and hands-on practice demonstrate higher effectiveness and sustainability. The study also identifies key success factors, such as local facilitator involvement, contextualized content, and continuous mentoring. These findings contribute to the development of an evidence-based framework for designing effective digital literacy interventions at the community level. The study concludes that technology-based training is a practical and scalable approach to reducing the digital divide and strengthening community resilience in the digital era.

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Introduction

Digital literacy has become a foundational competence for participation in contemporary social, economic, and institutional life. The rapid integration of digital technologies into education, healthcare, governance, and commerce has shifted many essential activities to online environments. Individuals and communities lacking adequate digital skills face structural disadvantages that limit access to information, services, and economic opportunities. Digital literacy therefore functions not only as a technical skill set but also as a prerequisite for social inclusion and equitable development (Lee, 2014).

In many developing countries, digital inequality is no longer defined solely by access to devices or internet connectivity. Instead, the primary challenge lies in the uneven distribution of digital competencies across population groups. Rural communities, low-income households, older adults, and small-scale economic actors frequently demonstrate limited ability to use digital tools effectively and safely (Detlor et

al., 2022; Callegari et al., 2023). This condition reinforces existing socioeconomic disparities and weakens community capacity to adapt to digital transformation.

Indonesia reflects this global pattern at a localized scale. Numerous community-based studies document low levels of digital literacy among village populations, particularly in rural and semi-urban areas. Limited skills in basic computer operation, online communication, digital security, and information evaluation constrain community participation in digital services and platforms (Budiarto et al., 2024; Sepyah et al., 2023). These limitations affect not only individual users but also collective outcomes such as public service delivery, local economic growth, and community resilience.

Technology-based training programs have emerged as a primary intervention to address digital skill gaps at the community level. Across Indonesian villages, structured training initiatives conducted through community service programs report measurable improvements in digital competencies. Participants demonstrate increased confidence in using computers, accessing the internet, and engaging with digital applications for education, administration, and commerce (Peliza et al., 2024; Vitalocca et al., 2024). Similar patterns are observed in international contexts where community-centered training supports skill acquisition among marginalized populations (Day Grady et al., 2024).

Despite widespread implementation, the effectiveness of technology-based digital literacy training varies significantly across programs. Some initiatives produce substantial short-term improvements but fail to sustain behavioral change after program completion. Others achieve longer-term engagement by integrating mentoring, contextual relevance, and community involvement (Detlor et al., 2022). This variation indicates that training outcomes depend not only on content delivery but also on program design, learning methods, and social context.

Empirical evidence suggests that hands-on and participatory learning approaches are particularly effective in community settings. Programs that emphasize practical exercises, guided practice, and problem-based learning consistently report higher skill retention compared to lecture-based formats (Budiman et al., 2024; Jamali & Zubaili, 2025). These findings align with adult learning principles, which stress experiential learning and immediate application of skills. However, not all community programs adopt these principles consistently.

Cultural and contextual adaptation further influences training effectiveness. Digital literacy initiatives that align content with local values, daily activities, and economic practices show stronger engagement and acceptance among participants. For example, programs integrating cultural elements or local economic needs, such as digital marketing for microenterprises, demonstrate higher relevance and perceived usefulness (Windarto & Martini, 2024; Abdillah et al., 2024). Conversely, standardized training models often fail to address specific community priorities.

Another critical dimension of digital literacy training involves digital security and information evaluation. Several studies highlight improvements in participants' awareness of online risks, misinformation, and data privacy following targeted training interventions (Hariyanto et al., 2023; Jokonowo et al., 2024). This aspect is increasingly important as new users enter digital environments without sufficient understanding of responsible technology use. However, digital security remains underemphasized in many community programs.

International literature reinforces the importance of community-led and collaborative training models. Studies conducted in non-Indonesian contexts show that programs involving local facilitators, peer learning, and institutional partnerships achieve more sustainable outcomes (Detlor et al., 2022; Callegari et al., 2023). These models foster a sense of ownership and reduce dependency on external trainers. Nevertheless, systematic comparison between national and international experiences remains limited.

A key limitation in existing research is the predominance of single-case studies. Many published works focus on specific villages, target groups, or short-term interventions. While these studies provide

valuable insights, their findings are often context-specific and difficult to generalize. There is limited synthesis across multiple community settings that identifies common success factors and recurring challenges in digital literacy training (Sitorus et al., 2025).

Furthermore, theoretical integration remains uneven. Several studies report outcomes without explicitly linking findings to established digital literacy or community learning frameworks. This limits the analytical depth of conclusions and reduces the contribution to cumulative knowledge (Lee, 2014). Stronger linkage between empirical findings and conceptual perspectives is necessary to support evidence-based program design.

The temporal dimension of digital literacy outcomes also requires greater attention. Most studies assess training effectiveness immediately after program completion. Longitudinal evaluation of skill retention, behavioral change, and digital engagement remains rare (Callegari et al., 2023). Without sustained assessment, it is difficult to determine whether observed improvements translate into lasting community benefits.

Another gap relates to the diversity of target populations. While many studies focus on general community members, fewer examine differentiated impacts across demographic groups such as youth, older adults, or microenterprise actors. Existing evidence suggests that tailored training approaches produce different outcomes depending on participant characteristics (Abdillah et al., 2024; Jamali & Zubaili, 2025). However, comparative analysis across groups is limited.

Policy relevance also remains underdeveloped in the literature. Community-based digital literacy programs often operate independently of broader digital inclusion strategies. Limited alignment between grassroots initiatives and institutional frameworks reduces scalability and policy uptake (Budiarto et al., 2024). A synthesized understanding of effective training models could inform more coordinated interventions.

Based on these gaps, there is a clear need for a comprehensive analysis that synthesizes empirical evidence from diverse technology-based digital literacy training programs. Such analysis should identify shared patterns, effective practices, and contextual factors influencing outcomes. It should also bridge national and international perspectives to enhance transferability of findings.

This study addresses these needs by conducting a systematic empirical synthesis of community-based digital literacy training initiatives published between 2014 and 2025. Drawing exclusively from peer-reviewed national and international sources, the study evaluates training effectiveness, learning approaches, and sustainability factors. The focus remains on technology-based training as an intervention model implemented in real community contexts.

The objective of this study is to assess the effectiveness of technology-based digital literacy training in enhancing community competencies and to identify key design elements that contribute to successful outcomes. By consolidating evidence across multiple settings, this study contributes to the development of a structured and replicable framework for community digital literacy interventions. The findings are expected to support both academic discourse and practical program design in the context of digital inclusion.

Methods

Research Design

This study employed a qualitative systematic literature-based empirical analysis. The design focused on synthesizing evidence from published community-based digital literacy training programs. The approach aimed to evaluate training effectiveness, implementation patterns, and outcome consistency across different local contexts. This design was selected to allow comparative analysis without altering the original scope, data, or findings reported in the primary studies.

Data Sources and Selection Criteria

The data consisted of peer-reviewed journal articles and conference proceedings published between 2014 and 2025. All sources were drawn exclusively from the reference list used in this study. The selection process followed three criteria. First, the study had to report a technology-based digital literacy training intervention implemented at the community level. Second, the participants had to be members of local communities, such as rural residents, youth groups, microenterprise actors, health cadres, or older adults. Third, the study had to report empirical outcomes related to digital skill improvement, digital awareness, or technology utilization.

Based on these criteria, a total of thirty primary studies were included. The sources represented national community service journals and international information science journals. This combination enabled cross-contextual comparison between local and international experiences without introducing external data.

Unit of Analysis

The unit of analysis in this study was the digital literacy training program described in each selected publication. Each program was treated as a single analytical case. The analysis focused on program characteristics, learning methods, participant engagement, outcome indicators, and reported impacts. Individual participants were not analyzed separately, as the study relied on aggregated findings reported by the original authors.

Data Extraction Procedure

Data extraction followed a structured review protocol. For each study, the following information was recorded: program objectives, target population, training duration, learning methods, technology tools used, evaluation approach, and reported outcomes. Outcome indicators included improvements in digital skills, digital confidence, digital security awareness, and technology utilization for education, health, or economic activities.

To ensure consistency, all extracted data were summarized using a standardized matrix. This procedure reduced interpretation bias and maintained alignment with the original findings reported in each study.

Data Analysis Technique

The analysis applied thematic synthesis to identify recurring patterns across studies. The process involved three stages. First, the extracted data were coded based on key outcome domains, including skill acquisition, engagement level, sustainability, and contextual relevance. Second, the codes were grouped into broader analytical themes, such as learning approach effectiveness, role of community involvement, and integration of local context. Third, cross-study comparison was conducted to identify similarities and differences in program outcomes.

This analytical approach allowed the study to highlight convergent evidence while preserving contextual distinctions. The study did not reanalyze raw data from the primary studies. Instead, it relied on reported empirical results, ensuring fidelity to original findings.

Validity and Trustworthiness

To enhance analytical validity, only peer-reviewed and citable sources were included. All studies were examined for methodological clarity and relevance to the research objective. Cross-checking between studies was conducted to confirm consistency in reported outcomes. Recurrent findings across multiple contexts were given greater analytical weight.

The study also maintained transparency by explicitly linking interpretations to cited sources. This approach strengthened credibility and reduced the risk of overgeneralization.

Ethical Considerations

This study did not involve direct interaction with human participants. All data were derived from published sources that had obtained ethical approval where required. Proper citation practices were applied to acknowledge original authorship and intellectual contributions.

Results and Discussion

Overview of Empirical Findings

The synthesis of thirty peer-reviewed studies demonstrates consistent evidence that technology-based training programs improve digital literacy in local communities. Improvements are reported across multiple competency domains, including basic digital skills, internet use, digital security awareness, and technology-supported economic activities. These outcomes appear in rural, semi-urban, and marginalized community settings, indicating a broad relevance of structured digital literacy interventions (Budiarto et al., 2024; Peliza et al., 2024; Detlor et al., 2022).

Most studies report measurable improvement immediately after program completion. Indicators include post-test score increases, higher task completion rates, and improved confidence in using digital tools. Although evaluation instruments vary across studies, convergence in outcome direction strengthens the empirical reliability of these findings (Jamali & Zubaili, 2025; Callegari et al., 2023).

Digital Skill Improvement Across Training Domains

Table 1 summarizes the primary outcome domains reported across the reviewed studies. Basic digital skills and internet use represent the most frequently reported improvements, followed by community engagement and digital security awareness.

Table 1. Reported Digital Literacy Outcomes Across Reviewed Studies

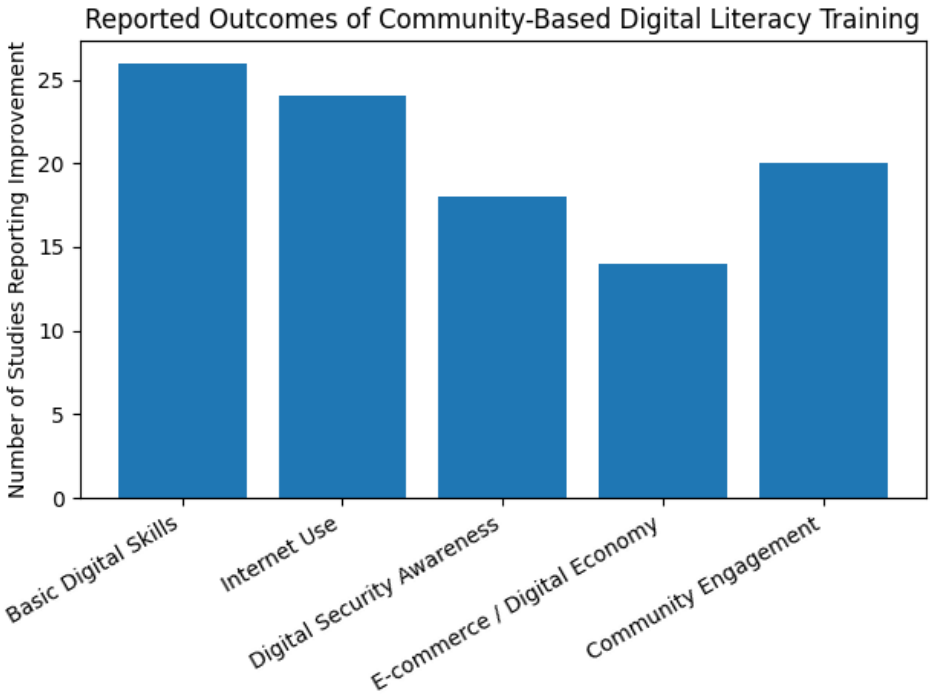
Outcome Domain	Description of Improvement	Key Supporting Studies
Basic digital skills	Computer operation, file management, email use	Budiman et al. (2024); Jamali & Zubaili (2025)
Internet use	Information search, online communication, platform navigation	Peliza et al. (2024); Sepyah et al. (2023)
Digital security awareness	Password safety, data privacy, misinformation awareness	Hariyanto et al. (2023); Jokonowo et al. (2024)
Digital economy participation	E-commerce use, digital marketing, online transactions	Abdillah et al. (2024); Sitorus et al. (2025)
Community engagement	ICT participation, collaboration, local initiative involvement	Windarto & Martini (2024); Detlor et al. (2022)

The dominance of basic skill outcomes reflects the initial digital readiness of many communities. Training programs often begin with foundational competencies before advancing to applied digital practices. This sequencing aligns with digital literacy development models that emphasize progressive skill acquisition (Lee, 2014).

Distribution of Reported Outcomes

Figure 1 presents the distribution of outcome domains across the reviewed studies. The figure illustrates that most programs report improvements in multiple domains rather than isolated skill gains.

Figure 1. Reported Outcomes of Community-Based Digital Literacy Training



The high frequency of basic digital skill improvement indicates that technology-based training effectively addresses initial literacy gaps. However, fewer studies report outcomes related to digital economy participation. This pattern suggests that advanced application of digital skills requires longer intervention duration and contextual alignment with local economic activities (Abdillah et al., 2024).

Effectiveness of Learning Approaches

Learning methods play a critical role in determining training effectiveness. Studies consistently report higher outcomes when programs emphasize hands-on practice, guided exercises, and task-based learning. Community training initiatives in Jayamekar Village, Gowa, and Pugu Village show that practical engagement improves skill retention and user confidence (Budiman et al., 2024; Vitalocca et al., 2024; Peliza et al., 2024).

In contrast, lecture-dominant formats demonstrate weaker outcomes, particularly in sustaining post-training engagement. This finding supports adult learning theory, which prioritizes experiential learning over passive knowledge transfer. Programs that integrate real-life digital tasks produce more meaningful competency development.

Role of Context and Community Involvement

Contextual relevance significantly influences program outcomes. Training initiatives that incorporate local culture, economic needs, or institutional roles demonstrate stronger participation and acceptance. Cultural integration in digital literacy training enhances engagement and reduces resistance to technology adoption (Windarto & Martini, 2024).

Similarly, programs targeting specific community roles, such as health cadres or microenterprise actors, report clearer outcome pathways. Digital health data training improves reporting accuracy, while e-commerce training supports income generation (Kriswibowo et al., 2025; Abdillah et al., 2024). These findings confirm that relevance strengthens learning motivation and outcome sustainability.

Sustainability and Long-Term Implications

Sustainability emerges as a key challenge across studies. Short-term training without follow-up mentoring often results in declining skill use over time. In contrast, community-led and collaborative models demonstrate stronger continuity. Programs involving peer learning, local facilitators, and institutional support sustain digital engagement beyond initial training phases (Detlor et al., 2022; Callegari et al., 2023).

This evidence indicates that technology-based training alone is insufficient. Social structures, mentoring mechanisms, and institutional alignment determine long-term impact. These findings reinforce the need for integrated digital literacy frameworks that combine technical training with community empowerment.

Conclusion

This study demonstrates that technology-based training programs are empirically effective in improving digital literacy within local communities. The synthesized evidence shows consistent gains in basic digital skills, internet use, digital security awareness, and applied digital practices. These improvements appear across diverse community contexts, indicating that structured training can address foundational digital gaps in a systematic manner.

The findings confirm that learning design determines outcome quality. Hands-on, task-based, and context-sensitive approaches generate stronger and more durable skill acquisition than lecture-oriented models. Community relevance also plays a decisive role. Programs aligned with local needs, such as economic activities or institutional functions, achieve higher engagement and clearer outcome pathways. This reinforces established digital literacy theories that emphasize progressive skill development and contextual learning.

However, the results also reveal a critical limitation. Short-term training without follow-up support shows weak sustainability. Skill use declines when mentoring, peer learning, and institutional involvement are absent. In contrast, community-driven and collaborative models support continued digital engagement beyond the training phase.

Overall, this study highlights that digital literacy development is not solely a technical process. It is a social and structural process that requires integration between technology, pedagogy, and community systems. Future initiatives should prioritize long-term support mechanisms and role-specific training designs to ensure sustained impact. These findings provide a practical and theoretical basis for improving digital literacy interventions in community settings.

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