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Local Wisdom and Pre-Bunking Strategies: Building Digital Resilience Against Misinformation in Indonesia

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Abstract

In an era of hypermediated polycrisis, building digital resilience is essential to counter the spread of misinformation that threatens democratic processes. This study examines how Indonesia's local cultural values and community-based movements contribute to strengthening digital resilience against misinformation. Drawing on empirical evidence from NGO-led pre-bunking initiatives, digital literacy programs, and the mobilisation of women's organisations such as the Family Welfare Empowerment (PKK) program, the study demonstrates how local wisdom shapes information verification practices. While culturally contextualised pre-bunking strategies provide critical frameworks for identifying misinformation, the findings show that resilience is ultimately enacted through community-based verification practices. These informal networks transform individual digital literacy into collective resilience via trusted intermediaries, hierarchical credibility assessment, and community knowledge exchange. Using a mixed-methods design that combines interviews with key stakeholders in Indonesia's digital literacy ecosystem and a quasi-experimental study with women's community groups, this study situates Indonesia's experience within the global discourse on digital resilience. It advances a community-centred model grounded in local empowerment, collective agency, and cultural continuity, offering an alternative to predominantly Western, individualistic approaches to combating misinformation.

Keywords

community-based digital literacy; cultural values; digital resilience; misinformation; pre-bunking strategies

1. Introduction

In an era of rampant misinformation, resilience has become central to safeguarding democratic and social systems. Resilience can be broadly understood as the capacity of groups or communities to cope with external stresses and disturbances by mobilising coping, adaptive, and transformative capacities to withstand crises and sustain societal well-being (Tomkova, 2020). Within the digital environment, Tomkova (2020) conceptualizes digital social resilience as the capacity of various social entities, from individuals to organizations, to leverage ICTs and online environments for sustaining social capital, cohesion, and collective efficacy. This conceptualisation highlights that resilience in digital environments encompasses social and cultural capacities that enable communities to withstand external shocks and hybrid threats.

Digital resilience entails understanding online risks, developing digital skills, and recovering from digital stressors with self-efficacy, while digital literacy encompasses the technical and cognitive skills that support these processes (Sun et al., 2022). Both are mutually reinforcing: Higher digital literacy predicts greater resilience, which in turn yields safer online behaviour, improved psychosocial functioning, and more effective coping with digital risks. In the misinformation context, resilience-oriented literacy interventions enhance the ability to distinguish true from false content and reduce susceptibility to manipulative messaging (Lee et al., 2025; Moore & Hancock, 2022).

Indonesia provides a salient case for examining digital resilience. Despite high social media penetration, resilience against misinformation remains limited. While 57% of Indonesians use social media as their primary news source (Newman et al., 2025), many lack strategies for evaluating information credibility (Suwana, 2021). This gap persists because digital resilience requires more than technical skills; it depends on collective verification practices embedded in the community (Kligler-Vilenchik, 2022) and cultural frameworks that prioritise group-based information evaluation (McDougall & Rega, 2022). Accordingly, this study examines how Indonesia's local cultural values and community-based movements strengthen resilience against misinformation.

Fact-checking, debunking, and pre-bunking all play important roles in countering misinformation; however, this study focuses on pre-bunking to explain how resilience can be built before misinformation circulates. Debunking research distinguishes preventive approaches from corrective ones and highlights the "continued influence effect," whereby misinformation often persists even after correction (Lewandowsky & van der Linden, 2021). Pre-bunking is particularly important in private messaging environments such as WhatsApp, where fact-checking faces structural constraints due to data privacy and reliance on third-party interventions (Reis et al., 2020). Drawing on inoculation theory, pre-bunking involves exposing individuals to weakened forms of misinformation in advance, thereby reducing susceptibility across contexts (Roozenbeek et al., 2020). Accordingly, this study examines how pre-bunking-oriented digital literacy can be implemented and embedded through community intermediaries rather than evaluating fact-checking effectiveness alone.

2. Literature Review

2.1. Digital Resilience

The concept of *digital resilience* has gained prominence as scholars attempt to capture how individuals, organisations, and societies adapt to and withstand disruptions in increasingly digitised environments. It has been approached from different disciplinary lenses. From the field of information systems and cybersecurity, Kohn (2023) frames digital resilience as humans' resilience in response to digital disruptions, framing resilience as a process capability, specified as "an employee's ability to continuously deliver the intended outcome despite adverse cyber events" in the organisational context (Kohn, 2023, p. 6437). Rather than treating resilience as simply "bouncing back" to a prior state, Kohn highlights that resilience involves creating new and improved trajectories of adaptation, where individuals and systems learn from disruptions, reorganise, and emerge stronger (Kohn, 2023).

Tomkova (2020) introduced the notion of *digital social resilience*, defined as "individuals', groups', or organizations' ability to maintain, change, recover, adapt to or recover their social capital mobilization, sustenance of social cohesion and collective efficacy, collective dignity—using ICT and the online space to do so" (Tomkova, 2020, p. 5). This conceptualisation is distinctive in emphasising bottom-up, community-driven processes of solidarity, collective mobilisation, and restorative ethics, rather than technical infrastructures of institutional legitimacy alone (Tomkova, 2020). Similarly, Esteve-Del-Valle, Costa, and Hagedoorn demonstrate how digital resilience can manifest through informal networks such as WhatsApp groups, which during the Covid-19 pandemic became crucial spaces for solidarity and mutual support (Esteve-Del-Valle et al., 2022). Both perspectives highlight resilience as an inherently social process grounded in interpersonal trust and collective efficacy.

Other communication scholars conceptualise digital resilience through the lens of misinformation, defining it as the capacity of societies to resist, cope with, and adapt to disinformation within digital media environments (Boulianne et al., 2022; Humprecht et al., 2020, 2023). Their comparative cross-national research demonstrates that resilience is unevenly distributed and contingent on institutional contexts, including media trust, media legitimacy, and regulatory safeguards. By situating resilience within broader media ecosystems, this scholarship underlines that resilience extends beyond individual cognition and is fundamentally shaped by political institutions, journalistic systems, and public culture.

Humprecht et al. (2020) advance a macro-level model of resilience that conceptualizes it as a nation's collective capacity to withstand disinformation, structured across three interrelated domains: politics (polarization and populism), media (trust in news, source diversity, and the strength of public service media), and economy/digital structures (reliance on social media for political information and digital market configurations). Resilience is operationalised through aggregate indicators, such as cross-national exposure to misinformation, underscoring the extent to which variations in resilience are shaped by country-level structural conditions (Humprecht, 2020; Humprecht et al., 2020). In contrast, Boulianne et al. (2022) adapt this framework to the individual level by examining citizens' awareness, exposure, and sharing of misinformation across four countries. Their findings indicate that macro-level assumptions do not translate straightforwardly to the micro level: While social media use consistently erodes individual resilience, trust in national news shows uneven and context-dependent effects (Boulianne et al., 2022; Humprecht et al., 2023).

Despite their significant contributions, both macro-structural and individual-level approaches leave an important analytical gap at the community level. The structural determinants emphasised by Humprecht et al. (2020, 2023) and the individual experiences examined by Boulianne et al. (2022) insufficiently account for how resilience is cultivated through collective practices, social networks, and cultural contexts. Addressing this limitation, this study foregrounds Tomkova's (2020) framework of *digital social resilience*. By situating resilience at the community level, this research highlights how local cultural values and community-based movements provide critical resources for resisting and adapting to misinformation. In doing so, it bridges macro-structural and individual approaches by demonstrating the role of community networks as a vital intermediary in transforming individual digital literacy into collective resilience.

2.2. Digital Literacy and Pre-Bunking Strategies

Contemporary pre-bunking and digital literacy strategies, as outlined by Bulger and Davison (2018), centre on five themes: youth participation, teacher training and curricular resources, parental support, policy initiatives, and the development of an evidence base. However, these foundations have attracted substantial critique, as they remain overly focused on individual-level interventions rather than the structural dynamics of platforms, lack national standards and consistent evaluation mechanisms, and are fragmented across demographic groups in ways that undermine systemic coherence (Bulger & Davison, 2018). This fragmentation is exacerbated by evidence that older adults are disproportionately susceptible to fake news and consume significantly more misinformation than younger populations, partly due to lower technological fluency and their non-digital-native status within contemporary information environments (Moore & Hancock, 2022; Walker et al., 2023).

Digital literacy and digital resilience have evolved as distinct research domains, yet their integration remains underexplored, particularly in explaining how individual competencies translate into collective defences against misinformation. Drawing on Sun et al. (2022), misinformation can be conceptualised as a form of digital adversity that exploits social and cognitive vulnerabilities, thereby weakening individuals' capacity to navigate online environments. This condition calls for resilience strategies that integrate information-evaluation capacities with social and culturally embedded filtering mechanisms—an analytical gap addressed by pre-bunking through anticipatory frameworks that reduce susceptibility before misinformation circulates through trusted networks.

Prior research frequently refers to "community-based" media or digital literacy initiatives, yet the organisational role of NGOs in designing, delivering, and sustaining these programs remains under-examined. Detlor et al. (2022) observe that there is "little, if any, scholarly work on the success of digital literacy initiatives run by local community organizations," despite their central role in reaching underserved publics. In Indonesia, media literacy and fact-checking efforts are largely implemented through civil society organisations, yet these initiatives remain fragmented and face sustainability constraints that affect program continuity and reach (Hendytio et al., 2024). Policy analyses further emphasise that NGOs function as key intermediaries for delivering digital literacy training and fact-checking activities at the community level, particularly where state-led interventions have limited penetration (Hammonds, 2024).

Pre-bunking is defined as a proactive strategy that reduces susceptibility to misinformation by exposing individuals to weakened or refuted versions of misleading content before encountering the actual falsehood.

Conceptually grounded in psychological inoculation, pre-bunking relies on refutational pre-emption to build resistance to persuasive misinformation by alerting individuals to potential manipulation prior to exposure (Lewandowsky & van der Linden, 2021). Pre-bunking trains individuals to recognise and resist manipulative messages before exposure. It is implemented through anticipatory warnings, factual clarifications, and media literacy programs. By presenting weakened misinformation alongside pre-emptive counterarguments, pre-bunking equips individuals with cognitive tools to resist future persuasive attempts. Furthermore, evidence suggests that pre-bunking is generally more effective than debunking, which is reactive and only occurs once misinformation has already been spread (Lewandowsky & van der Linden, 2021; Roozenbeek et al., 2020; Tay et al., 2022).

Inoculation theory forms the foundation of pre-bunking strategies against misinformation. Originating in McGuire's 1960s work, it uses a vaccination metaphor: Exposure to weakened, misleading arguments with refutations builds psychological resistance (Lewandowsky & van der Linden, 2021). The process consists of two essential components: (a) *threat* or *forewarning*, which alerts individuals to the likelihood of encountering manipulative messages and activates a "mental immune response," and (b) *refutational pre-emption*, which supplies counterarguments to contest deceptive claims (Traberg et al., 2023). Once "inoculated," people are better prepared to detect and resist stronger misinformation. This resistance is strengthened by learning to identify rhetorical devices, manipulative techniques, and logical fallacies, enhancing their ability to anticipate and counter false content (Lewandowsky & van der Linden, 2021).

Digital literacy serves as the foundational layer for effective pre-bunking interventions. While pre-bunking provides the anticipatory frameworks for recognising misinformation, digital literacy supplies the technical skills and critical thinking capabilities necessary to apply these frameworks across different platforms and contexts. Sun et al. (2022) describe how this integration operates through a circular process where pre-bunking training enhances digital literacy, while improved literacy increases receptiveness to pre-bunking interventions. Drawing on inoculation theory and community-based digital literacy research, scholars conceptualise pre-bunking as an anticipatory approach that can be operationalised through sustained, community-tailored literacy programs. Such programs aim to build verification habits, including lateral reading and claim–evidence reasoning, before individuals are exposed to misinformation (Lee et al., 2025; Lewandowsky & van der Linden, 2021; Low et al., 2025; Moore & Hancock, 2022; Roozenbeek et al., 2020).

Evidence from community-based interventions shows that tailored digital/media-literacy workshops improve both comprehension and the ability to distinguish true from false content, particularly when delivered through trusted local organisations and adapted to audience characteristics (Lee et al., 2025). A critical and dynamic approach to digital media literacy further strengthens upstream resilience by training users to interrogate sources, contexts, and power (Low et al., 2025; McDougall, 2019). Design-oriented learning tools that scaffold systematic rather than heuristic information processing help users cope with information overload and high-uncertainty environments, thereby enhancing digital resilience as an anticipatory capacity rather than a reactive response (Jung et al., 2025; Moore & Hancock, 2022). Together, these findings support pre-bunking as recurring, locally embedded programs with hands-on practice environments, rather than one-off awareness campaigns (Lee et al., 2025; Smit et al., 2024).

Within the literature on pre-bunking, digital literacy is increasingly positioned as a core curricular component encompassing both civic-critical media literacy (source evaluation, evidence appraisal, lateral reading)

delivered as a habit-building practice, as well as social media literacy and algorithmic awareness of how ranking, recommendation, and datafication shape exposure and sharing (Cho et al., 2024; Low et al., 2025). Guided drills using learning tools prompt participants to systematically scrutinize headlines, links, and provenance, with immediate reflection on indicators of manipulation (Moore & Hancock, 2022). Other studies stress the importance of inclusive, context-specific pedagogy that leverages community intermediaries (e.g., small-group micro-teaching for older adults) to translate individual skills into collective verification practices (Astuti et al., 2024; Smit et al., 2024). While the literature varies in its emphasis and implementation, digital literacy is always positioned as an integral element of pre-bunking approaches, referring to a set of knowledge resources, habitual practices, and social infrastructures that are associated with community-level preparedness against misinformation (Cho et al., 2024; Lee et al., 2025).

2.3. The Social Basis of Information Processing and Community-Based Digital Literacy

Humans have a basic drive to belong to groups to obtain information (Shaw et al., 1999). Shaw et al. (1999) define groups as "collections of people based on some shared values, attitudes, or opinions" that range "from formal groups with specific requirements to those that are very loose" (p. 5). When individuals join groups, they integrate personal perspectives with group perspectives, creating collective frameworks for evaluating information (Shaw et al., 1999). McWhorter (2020) then demonstrates that participation in group-based activities positively associates with increased news literacy. McWhorter's study indicates that literacy development occurs through social rather than purely individual means.

Metzger and Flanagin (2013) identify social endorsements as a key credibility heuristic, where individuals assess information credibility based on social validation signals. However, existing research on social influence (McWhorter, 2020) and social endorsements (Metzger & Flanagin, 2013) has focused on how these processes operate at the individual level. A critical gap exists in understanding how these individual-level processes scale to function as collective practices within community contexts, especially in offline settings.

Recent scholarship addresses this gap by examining collective verification in a group-level context. Kligler-Vilenchik (2022) introduces the concept of collective social correction, which is defined as ongoing practices of information verification and correction occurring within group contexts. Through analysis of information verification practices in WhatsApp groups, Kligler-Vilenchik demonstrates how group dynamics and norms shape collective verification processes with group members co-constructing standards for information sharing and accountability. However, Kligler-Vilenchik's study focuses on online messaging groups where participants interact primarily through text-based messages.

Our focus extends this to community-based organisations. Following Gilchrist (2019), community networks are defined as groups characterised by informal interactions and routine relationships that enable members to exchange resources and share experiences through a shared sense of belonging. In community-based organisations, geographic proximity and sustained face-to-face interaction, alongside digital communication, create collective verification dynamics that differ from purely online settings. Collective verification thus operates through group consultation and community-level consensus rather than individual fact-checking alone, allowing digital literacy to function as a social practice in which members pool knowledge, exercise collective judgment, and develop shared standards for information sharing (Kligler-Vilenchik, 2022).

Allen et al. (2025) argue that researchers should study the impact of misinformation depending on whether it is consumed in social groups or individual settings, noting that community-based solutions show promise. However, they acknowledge that empirical research on how collective processes operate in offline community settings remains limited. This study addresses this gap. Research on community-led digital literacy training shows that effectiveness depends on how well interventions are customised for specific populations (Detlor et al., 2022). These findings underscore that effective digital literacy training cannot be separated from the cultural and community contexts in which it is delivered.

Research demonstrates that digital literacy is deeply situated in cultural, social, and educational contexts (McDougall & Rega, 2022). While Western digital literacy frameworks (e.g., European Digital Competence Framework) increasingly recognise collaborative competences, non-Western scholarship emphasises how cultural backgrounds shape digital literacy practices differently than individualistic Western approaches (Choudhary & Bansal, 2022). In collectivist contexts, digital literacy is frequently associated with community empowerment and collective action rather than purely skill acquisition (Choudhary & Bansal, 2022).

Indonesia represents a compelling non-Western case for analysing digital resilience. While 57% of Indonesians use social media as their primary news source, compared to 44% who use TV and 10% who use print, trust in news remains low at 36% (Newman et al., 2025). Social media's prominence makes it a growing site for misinformation and political propaganda, often amplified through paid influencers. This context necessitates community-based approaches alongside formal institutional efforts.

2.4. Research Questions and Objectives

Given the previous theoretical foundations and the identified gaps in understanding non-Western approaches to digital resilience, this research addresses the following questions:

1. How do formal pre-bunking strategies interact with community-based initiatives and NGO-led digital literacy programs to strengthen resilience against misinformation?
2. How do Indonesia's local cultural values and community-based movements shape and strengthen digital resilience against misinformation, particularly through collective verification practices?

3. Methodology

This study employs a mixed-methods approach combining institutional stakeholder interviews with a quasi-experimental study of women's community organisation to analyse how formal and informal networks contribute to digital resilience in Indonesia. The stakeholder interviews provide insights into institutional frameworks and policy intentions, while the quasi-experimental component examines how these frameworks are mediated and transformed through community-based digital literacy interventions.

3.1. Semi-Structured Interviews

Ten semi-structured interviews were conducted with key stakeholders from organisations involved in pre-bunking efforts (see Table 1) between September and November 2024. Interviews were conducted both through face-to-face meetings and via online platforms such as Zoom in Bahasa Indonesia, with an average

duration of approximately 1.5 hours each. An interview guide was developed, drawing upon key themes identified in the literature review section. The interviews employed open-ended questions, enabling respondents to articulate their perspectives on pre-bunking initiatives and the digital literacy programs they organised. Data were analysed using thematic analysis following Braun and Clarke (2022).

Table 1. Stakeholder informants.

Informant	Role/Affiliation
1	Kompas.com
2	Liputan6.com
3	Cekfakta.com and Alliance of Independent Journalists (AJI)
4	Ministry of Communication and Informatics, Indonesia
5	Indonesia Cyber Media Association (AMSI)
6	Indonesian Anti-Hoax Society (Mafindo) and Tular Nalar
7	Indonesian Advertising Companies Association
8	Suara.com
9	Press Council's Commission on Complaints and Ethics Enforcement
10	Press Council's Commission for Education, Training, and Professional Development

3.2. Quasi-Experimental Study

The quasi-experimental method addresses a gap in digital resilience research by examining how community-based digital literacy interventions shape information verification behaviours in community contexts. A quasi-experiment compares outcomes between treatment and control groups without random assignment (Baldassarri & Abascal, 2017). In this research, random assignment was not feasible because participants were organised in informal friendship groups of 2–3 individuals with strong social bonds and high cohesiveness, which are central to this study. Preserving these natural groupings offered methodological advantages and facilitated more open and candid interaction when they were surrounded by trusted friends, enabling observation of authentic collective verification practices. This design allows systematic comparison between groups while capturing how digital literacy interventions operate through existing community networks.

3.2.1. Participants

Participants were recruited from the Indonesian Family Welfare Empowerment Program (PKK), a social development movement established in 1957 and expanded nationally in 1972 (Daniswari, 2022). PKK operates through hierarchical structures from the national level down to neighbourhood units, organising regular meetings and community development activities. PKK members, predominantly housewives, are central to household and community, yet often overlooked in misinformation research, despite their potential influence on information dissemination and interpretation.

Forty-nine PKK members from Jakarta participated in the study between 11 and 15 November 2024. Participants were recruited through PKK organisational channels, with local coordinators announcing the research opportunity through WhatsApp groups. Inclusion criteria required active PKK membership and

regular social media use (defined as accessing platforms at least once daily). Participants joined the study as individual PKK members rather than as formal organisation representatives. Participants were assigned to two groups: a treatment group ($n = 20$) and a control group ($n = 29$). The unequal distribution resulted from some participants arriving late and being assigned to the control group to maintain group dynamics. Participants were mixed across education levels, age ranges, and income brackets to minimise group bias. Figure 1 illustrates the procedures for the treatment and control groups.

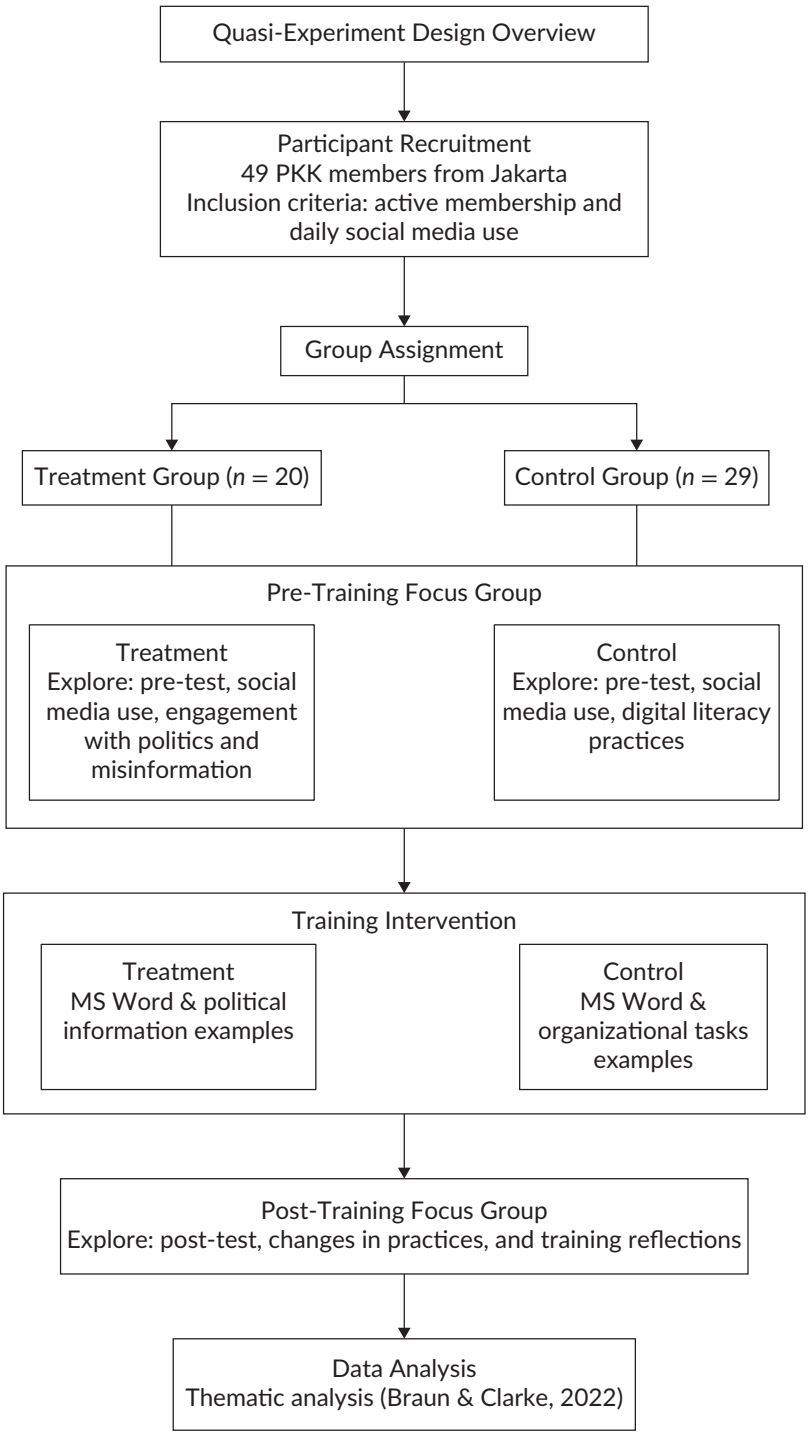

Figure 1. Flow diagram of quasi-experimental design.

3.2.2. Intervention Design

Both groups received four hours of Microsoft Word training, as requested by PKK members for organisational needs. The treatment group used examples related to political information during the pre-electoral period, while the control group used examples from routine organisational activities, such as preparing meeting minutes, organising membership data in tables, and formatting reports. Both groups, therefore, received equivalent technical instruction and practice time, differing only in exercise content. Training was delivered by facilitators with assistance from training assistants, using a participatory approach emphasising group discussion and collaborative learning. All sessions were observed by the research team. This observational approach enabled documentation of collective verification practices as they unfolded in real time.

The training for the treatment group incorporated the following main exercises:

- Exercise 1: Fact vs. Misinformation. Participants categorised 10 headlines in a two-column table: 5 from mainstream news sources covering the November 2024 regional election, and 5 debunked misinformation from the January 2024 presidential election (sourced from the Ministry of Communication and Information's fact-checking portal). Presidential misinformation was used because regional misinformation had not yet been debunked, whereas presidential misinformation had been documented throughout 2024. This exercise required participants to practice collaborative information assessment while developing table formatting skills.
- Exercise 2: Fact vs. Opinion. Participants practised distinguishing factual claims from opinion statements using locally relevant examples. Facts were drawn from the training day's local market commodity prices (e.g., "eggs cost IDR 12,000 per kilogram"), providing concrete information familiar to participants' daily activities. Opinions were collected from social media posts discussing contemporary social issues (e.g., "traditional values are disappearing"), representing the types of claims participants regularly encounter in their social media environments. This combination enabled participants to distinguish verifiable facts from subjective evaluative statements. Participants created tables organising these statements into fact and opinion categories.

3.2.3. Procedure

The quasi-experimental design consisted of three phases: (a) pre-training focus groups, (b) a digital literacy training intervention, and (c) post-training focus groups. Focus groups were selected over individual interviews for three reasons: They align with Indonesian cultural preferences for collective discussion, allow direct observation of how information verification practices emerge through social interaction, and reflect the study's emphasis on collective rather than individual verification processes.

Pre-training focus groups began with a standardised pre-test for both groups, followed by semi-structured focus group discussions. The treatment group discussed media use, engagement with political news, and experiences navigating potential misinformation, whereas the control group focused on general media use and everyday digital literacy practices. Each focus group session lasted 60–90 minutes and followed a semi-structured protocol to ensure consistency while also allowing themes to develop naturally.

The four-hour training intervention was delivered as described in Section 3.2.2. During training sessions, researchers conducted observations by recording field notes on group dynamics, interaction patterns, and spontaneous discussions related to information verification that emerged during collaborative exercises.

Post-training focus groups were conducted with the same participant groupings and semi-structured protocols as in the pre-training phase. These sessions included a post-test to assess skill retention, followed by reflective discussions on the training experience and perceived changes in information verification practices.

All interactions across pre-training, training, and post-training phases were audio-recorded using two digital recorders to capture all participant contributions. Recordings were transcribed verbatim in Bahasa Indonesia, translated into English, and analysed using thematic analysis following Braun and Clarke (2022), with particular attention to proxy indicators of digital resilience, including changes in verification behaviours, the emergence of collective information assessment, and the adaptation of cultural values to digital information processing.

4. Findings

4.1. Pre-Bunking Strategies: Role of NGOs and Societal Actors

This section reports the empirical findings on how key Indonesian actors implement pre-bunking strategies and digital literacy programs to counter misinformation. The results are organised into four themes: cross-organisational collaboration and innovation; pre-bunking content production and curricular work; capacity-building and institutional infrastructures for news credibility; and community-based pre-bunking.

4.1.1. Cross-Organisational Collaboration and Innovation

A central finding is that pre-bunking in Indonesia is enacted through cross-organisational collaboration, particularly among journalism organisations, fact-checkers, and civil society actors. AJI (Alliance of Independent Journalists) and Cekfakta.com (fact-checker organisation) collaborate closely with organisations such as Mafindo (Indonesian Anti-Hoax Society) and AMSI (Indonesia Cyber Media Association) alongside other media organisations under the Indonesian Fact-Checking Network to combat misinformation through pre-bunking and digital literacy initiatives. This collaboration spans multiple issue areas, including health and political disinformation. As Informant 3 mentioned, “There is pre-bunking effort through collaboration between Mafindo, AJI, and AMSI. Most of it relates to politics, but we have also started addressing health and other areas.” The same informant emphasised that these efforts aim to “create awareness before false information spreads,” framing pre-bunking as a preventive, “vaccine-like” approach.

Beyond collaboration, innovation is evident in the development and deployment of verification tools. Mafindo operates professional fact-checking infrastructures using internal tools (Yudistira, Bharata) and public-facing tools such as Hoax Cluster and the Kalimasada WhatsApp chatbot, which allow users to verify information directly. Mafindo has begun exploring the use of AI to predict and pre-bunk potential hoaxes based on recurring patterns, particularly in election contexts. Although still experimental, these initiatives represent early efforts to anticipate misinformation before it circulates widely.

4.1.2. Pre-Bunking Content and Curriculum

Pre-bunking content is produced by observing recurring misinformation themes and translating them into early warnings and educational materials. AJI and Cekfakta.com create pre-bunking content covering health, politics, and celebrity misinformation, often using multimedia formats such as infographics and videos. Interactive formats, including games and quizzes (e.g., *Recheck Before Getting Fooled*), are used to encourage critical engagement and teach people to evaluate critically the information they encounter online, rather than to passively consume it. The AMSI website features an e-learning platform that provides comprehensive educational resources on digital literacy and fact-checking. Additionally, the website offers downloadable modules focused on fact-checking and digital literacy training.

As Informant 3 explained, "Cekfakta.com started creating pre-bunking content, especially after seeing recurring disinformation topics in health and politics, to alert the public before the misinformation spreads widely." Beyond content production, stakeholders emphasised curricular integration as a long-term pre-bunking strategy. In collaboration with Mafindo, AJI has developed educational curricula aimed at fostering critical thinking about misinformation, including initiatives targeting elementary and secondary education. Informant 3 highlighted this expansion: "We're also pushing for digital literacy through the development of educational curricula, including for elementary and secondary education, and collaborating with various media organisations to integrate fact-checking into their content." Cekfakta.com further complements these efforts by offering learning modules focused on fact-checking, media literacy, and critical assessment, alongside proactive educational campaigns using multimedia formats.

4.1.3. Capacity-Building and Credibility Infrastructure

AMSI plays a central role in strengthening journalists' fact-checking capacities through regular and systematic training programs for journalists working in online media, designed to improve fact-checking capabilities. A key feature of this system is mentorship: AMSI mentors (journalists trained by AJI) train and guide representatives from 10 online media outlets each, with the training focusing on digital literacy and both pre-bunking and debunking techniques to support the production of fact-checked content. These programs rely on a cascading mentorship model, where journalists trained by AJI through Training of Trainers (ToT) subsequently mentor representatives from multiple online media outlets. AMSI also regularly organises news literacy training for the public, aimed at combating dis/misinformation. AJI's online presence features digital literacy and pre-bunking programs, including collaboration with Google News Initiative to run ToT.

However, this capacity-building infrastructure also revealed constraints. According to Informant 5, many of these outlets struggle even with producing basic hard news, making the additional task of fact-checking even more challenging. Furthermore, Informant 5 pointed out that many journalists lack critical thinking skills, which are essential for fact-checking. The mentor noted that part of the challenge in the training was fostering critical awareness among journalists, as not all of them possess the necessary mindset for scrutinising information.

In parallel, the Press Council supports media credibility by providing structured education and training, competency tests, and mentorship to strengthen journalistic standards and legal-ethical awareness. Its programs cover competency requirements, newsroom workflows, digital literacy, distinguishing dis/misinformation, and verification, while preparing examiners and administering tiered Journalist

Competency Tests. The Council also enforces professionalism through sanctions for violations of the Journalistic Code of Ethics, including removal from membership, which results in losing Council recognition and essential legal protection. As Informant 9 stated:

> Fabricating hoaxes and other such acts are major violations. The Press Council has imposed strict sanctions, and we do so without exception toward anyone who commits such acts. Recently, we have already ruled against two media outlets for fabricating fake news. We no longer consider them as press companies, and all their complaints to the Press Council have been dismissed.

4.1.4. Community-Based Pre-Bunking

Community-based pre-bunking is primarily implemented through Mafindo's Tular Nalar program, which focuses on public education and engagement. The program explicitly targets vulnerable groups, including first-time voters, the elderly, and underserved communities in remote areas, aiming to foster critical thinking, digital literacy, and responsible digital behaviour among these groups (Informant 6). The scale of Tular Nalar's outreach is extensive. Informant 6 stated:

> For senior citizens and first-time voters, we are conducting digital literacy training. Currently, we are holding 500 classes to reach 1.6 million people. For first-time voters, the classes are called the "Sekolah Kebangsaan" [Indonesian civic school], and they are ongoing.

Tular Nalar's curriculum is systematically designed across three levels (basic, middle, advanced) and four thematic clusters (social media, digital safety, digital commerce, digital entertainment). The curriculum was developed through literature review, focus group discussions, and pilot testing. Learning is reinforced through pre- and post-assessments, reflective activities, mentoring, and supplementary tools (infographics, cards, video games), enabling participants to integrate safe digital practices into everyday life. In addition to in-person training, Tular Nalar disseminates pre-bunking and digital literacy content through social media and partnerships. Collaborations with organisations such as the Indonesian Community Radio Network allow outreach to underrepresented and remote communities, extending pre-bunking beyond formal training settings.

4.2. Local Indonesian Values and Collective Verification Practices

This quasi-experimental study with PKK women reveals how institutional frameworks are mediated through community networks, demonstrating both opportunities and limitations in translating formal pre-bunking strategies into community-level resilience.

4.2.1. Information Verification Behaviours

Prior to the intervention, both groups demonstrated similar baseline approaches to information sharing. Participants reported extensive participation in WhatsApp groups. Analysis of pre-training focus groups revealed existing information forwarding behaviours followed patterns based on content utility and source trust. They showed a high tendency to forward community announcements (e.g., work service announcements and PKK activity invitations); moderate tendency to forward political information (e.g., aid

announcements or campaign promises); and low tendency to forward suspicious content. When asked about suspicious content, participants stated responses such as "If a message is suspicious, I'm not brave enough to forward it immediately, just read it."

Following the intervention, groups demonstrated different verification approaches. Treatment group participants described implementing multi-step verification processes. Thirteen participants mentioned comparing information across two or three platforms. Eighteen participants identified "forwarded multiple times" labels in WhatsApp as verification triggers. One participant explained: "I like to check other social media like Instagram or Facebook. If it is consistent, then the content can be trusted." On the other hand, control group participants prioritised official organisational sources. They maintained more straightforward verification approaches. They described approaches such as "I will read first," "sometimes search in Google too," and "look for the source first."

Both groups demonstrated trust hierarchies in information evaluation. Institutional sources received the highest trust ratings across both groups. Community leaders deemed to have high digital skills received moderate trust ratings. Anonymous social media content received the lowest credibility scores. Treatment group participants mentioned checking for verification markers before trusting suspicious information, including looking for checkmarks in account names. They used television news as reference points, comparing whether similar news had appeared on TV.

Treatment group participants demonstrated political awareness, as they acknowledged receiving campaign benefits (e.g., free groceries) while still realising they were able to maintain voting independence. One participant noted, "We have suspicion and resistance, possibly because many political candidates approached housewives, thinking [we are] an easy audience."

4.2.2. Platform Usage and Knowledge Exchange

All 49 participants showed sophisticated social media engagement; they either managed or actively participated in three to seven WhatsApp groups simultaneously. Forty-seven participants showed advanced TikTok capabilities, including the ability to search for recipes, religious instruction, and community information. In contrast, 43 participants required assistance with computer-based Microsoft Word training. Only 7 participants demonstrated familiarity with basic keyboard shortcuts. Thirty-eight older participants relied on family members for computer operations.

During the intervention, both participant groups demonstrated intergenerational knowledge-sharing that enhances community resilience capacity. Younger participants (age 25–35) demonstrated greater technical skills, while older participants showed higher engagement with discussion topics. This created spontaneous peer learning opportunities, where younger participants actively assisted older peers with technical aspects while benefiting from older participants' experiences with information evaluation during discussion sessions.

Both treatment and control participants demonstrated strong preferences for discussing suspicious information collectively before making sharing decisions. Social influence patterns included strong peer influence on platform choice, collective decision-making in information credibility assessment, and group-based verification dynamics within PKK networks.

5. Discussion

5.1. Individual Layer

At the individual level, the findings reinforce arguments in the literature that digital literacy alone does not automatically translate into digital resilience when confronting misinformation. Treating misinformation as a form of digital adversity, prior research emphasises that individual competencies become protective only when they are activated before exposure and supported by broader social contexts (Sun et al., 2022). Differences in participants' performance across platforms are consistent with work showing that digital literacy is not a uniform or fully transferable skill set but is shaped by platform- and algorithm-specific affordances that structure exposure and sharing practices (Cho et al., 2024). This supports the relevance of preventive, inoculation-based approaches, as pre-bunking aims to build resistance prior to exposure and has been shown to reduce susceptibility to misinformation (Lewandowsky & van der Linden, 2021; Roozenbeek et al., 2020).

The quasi-experimental findings reveal that individual digital literacy serves as a necessary but insufficient foundation for digital resilience in Indonesian communities. Both treatment and control groups demonstrated improvement in technical skills following Microsoft Word training, confirming that structured interventions can enhance individual competencies. However, the divergent outcomes between groups illuminate the critical distinction between skills acquisition and resilience development. The treatment group's exposure to political information examples during training facilitates what Sun et al. (2022) describe as the circular relationship between literacy and resilience. Participants who engaged with misinformation-related content strengthened their evaluative capabilities, with systematic verification processes emerging as evidence of this circular development. This finding demonstrates that digital literacy becomes most effective when contextually relevant to actual threats participants encounter in their information environments.

The findings reveal a platform-specific competency gap that challenges assumptions about the transferability of digital literacy. Participants required substantial assistance with computer-based tasks yet demonstrated sophisticated engagement with mobile platforms where misinformation predominantly circulates, underscoring that digital literacy operates in platform-contingent ways rather than as a universally transferable skill. This misalignment between formal, computer-based literacy training and participants' everyday information environments suggests that resilience-building interventions are most effective when they activate existing competencies on mobile platforms instead of presuming skill transfer across contexts.

At the same time, the limited performance in fact–opinion categorization tasks highlights the constraints of purely skills-based approaches. Treatment participants achieved only 58% accuracy overall and struggled markedly with culturally nuanced statements, reaching just 30% accuracy for context-specific examples. In line with the discussion's emphasis on digital resilience as socially embedded, these results indicate that individual cognitive capabilities, while necessary, require cultural and social supports to function as effective resilience mechanisms.

The persistence of collective decision-making preferences aligns with research showing credibility judgments as a socially embedded process (Kligler-Vilenchik, 2022; Metzger & Flanagin, 2013). Even participants who developed enhanced individual verification capabilities continued seeking collective

consultation before sharing information. This behaviour indicates that individual competencies serve as inputs to community-based resilience processes rather than standalone solutions (Detlor et al., 2022).

5.2. Community Layer

The women's institution findings provide compelling evidence for Tomkova's (2020) framework, emphasising community-driven processes of collective mobilisation. The research demonstrates that sustainable digital resilience emerges through collective verification practices that transform individual literacy into community-wide protective mechanisms.

The research reveals that women's organisations, such as PKK, are crucial nodes in community resilience networks. PKK women function as information intermediaries who filter and contextualise content before it reaches broader community audiences. The experimental findings show how these women develop collective strategies for managing information threats while maintaining their roles as community knowledge brokers. This finding extends Tomkova's (2020) emphasis on social capital mobilisation by demonstrating how gendered social roles can serve as resilience infrastructure. Our findings reveal three mechanisms through which community networks enable collective verification against misinformation.

First, Indonesian cultural values create structured pathways for information processing that function as resilience infrastructure. The research identified specific trust hierarchies that create predictable information flow patterns that can be leveraged for community protection against misinformation. Participants consistently prioritised institutional sources (government, established media) over anonymous content. Treatment group participants demonstrated sophisticated integration of these cultural hierarchies with systematic verification approaches. One participant's statement, "If a message is from our community leader, we still verify it, but also we respect their knowledge," illustrates how cultural values around authority respect can coexist with critical evaluation practices. Participants demonstrated collective verification through group consultation, reflecting Kligler-Vilenchik's (2022) concept of collective social correction and Metzger and Flanagin's (2013) concept of social endorsements by showing how communities establish collective hierarchies of source credibility.

Second, intergenerational knowledge exchange, which occurred during training, enables group-based fact-checking. Younger PKK members' digital fluency, combined with older members' contextual knowledge, created complementary verification resources. This collaborative competence reflects what Gilchrist (2019) identifies as central to well-connected communities. These findings challenge Western models that assume resilience develops through individual skill accumulation rather than social knowledge distribution. Instead, the Indonesian community approach demonstrates how different generations can contribute specialised knowledge to create a collective capacity that exceeds what any individual could achieve alone. This finding suggests that effective resilience interventions should build on existing social learning dynamics rather than implementing individualistic training approaches.

Third, accountability norms embedded in community expectations discourage sharing unverified information. The finding that participants avoided sharing suspicious content to maintain credibility within their networks demonstrates Kligler-Vilenchik's (2022) concept of collective social correction, where group norms shape individual behaviour.

Rather than universal scepticism toward all sources, the Indonesian approach shows how cultural values can enhance rather than inhibit critical evaluation by providing stable reference points, reflecting the culturally situated nature of digital literacy (Choudhary & Bansal, 2022; McDougall & Rega, 2022). These reference points reduce cognitive load while maintaining protective scepticism toward anonymous or unverified sources.

Figure 2 illustrates our proposed integrated model of digital resilience, which addresses a critical gap in existing interventions that focus on either individual skill-building or institutional frameworks while neglecting the community. This model offers a replicable approach for contexts seeking culturally grounded resilience.

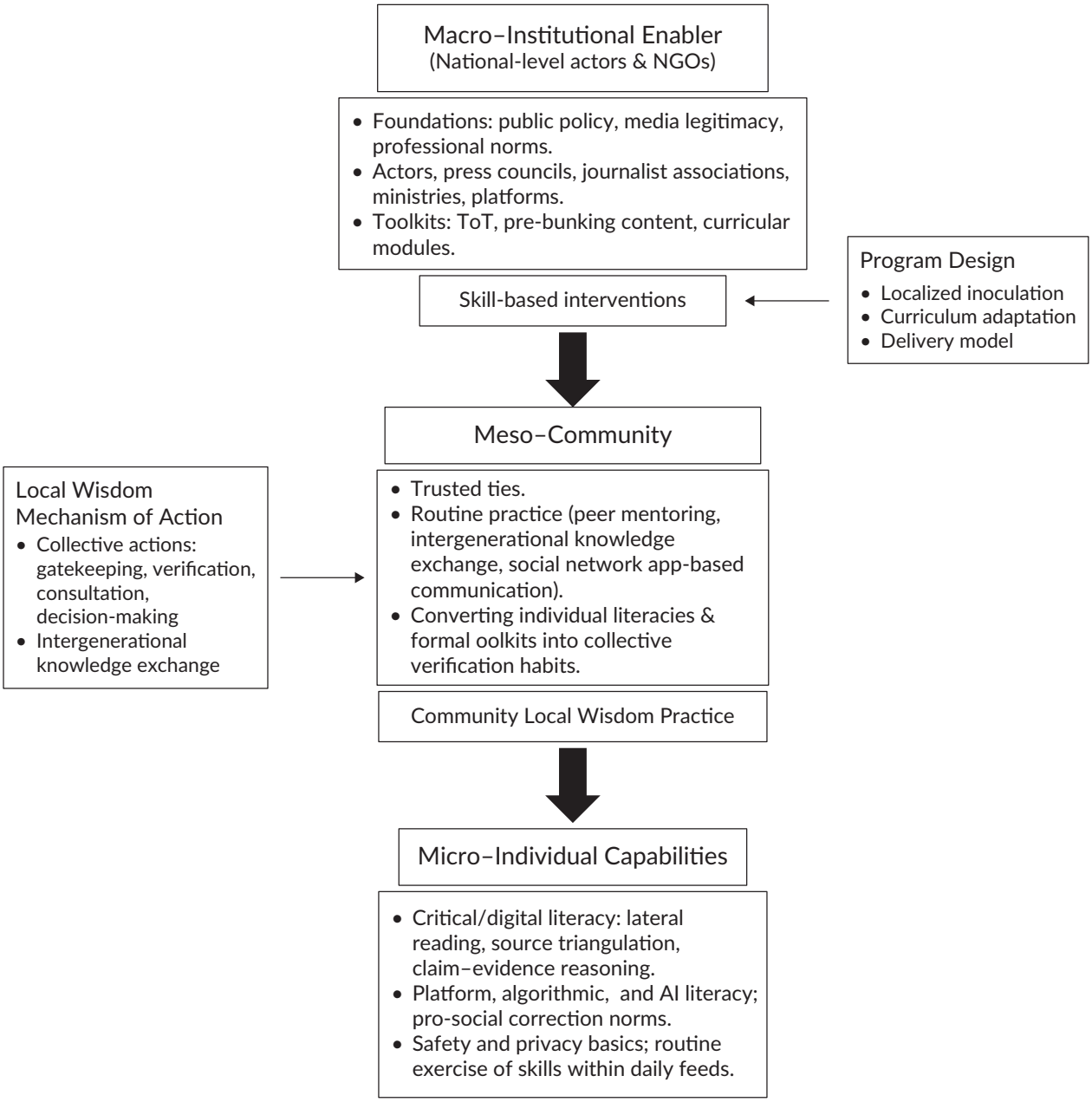

Figure 2. Community-focused digital resilience model.

Drawing together our findings and the literature, we argue that formal pre-bunking strategies in Indonesia gain effectiveness when they are integrated into NGO-led digital-literacy programs and existing community infrastructures, producing a multi-level resilience consistent with Humprecht's framework. National-level actors and professional networks translate macro determinants of resilience (media legitimacy, professional norms, regulatory safeguards) into anticipatory, skills-based interventions (ToT, pre-bunking content, curricular modules) that provide early warning and equip individuals with counterarguments before misinformation begins to spread. Community organisations such as PKK then socialise these frameworks through their networks and routine practice (peer mentoring, intergenerational knowledge exchange, WhatsApp-based deliberation), converting individual literacies into collective verification habits—precisely the meso-level mechanism that Humprecht's model leaves underspecified. In line with the literature review, programs that mix inoculation-style pre-bunking with "dynamic" digital literacy (critical source evaluation, lateral reading, and platform/algorithmic awareness) shift participants from heuristic forwarding to systematic scrutiny, while inclusive pedagogy (micro-teaching, locally relevant examples) lowers cognitive and cultural barriers to uptake. This produces a positive cycle (Figure 2): Formal institutions provide shared anticipatory frameworks, NGO-led training events develop transferable skills, and community networks weave those skills into everyday decisions—thereby strengthening resilience to misinformation across institutional, organisational, and community levels.

6. Conclusion

Formal pre-bunking strategies provide anticipatory knowledge frameworks through national actors and NGOs, including inoculation-based content, ToT, and curricular modules. Community organisations such as PKK translate these frameworks into everyday practice through peer mentoring, group consultation, and trust-based information filtering, thereby embedding collective verification routines in daily information use. Indonesian cultural values sustain collective information-processing practices (such as message gatekeeping, collective verification, and group-based decision-making) that persist beyond individual-focused digital literacy training. By integrating cultural values with information-checking behaviours, the Indonesian case suggests that effective digital resilience is most likely to emerge when interventions work within existing cultural frameworks, offering insights for contextually grounded resilience models addressing the global challenge of misinformation.

These findings provide practical implications for digital literacy practitioners and policymakers. Resilience interventions should be integrated into existing community organisations (e.g., women's groups, religious associations, and neighbourhood networks) that already function as trusted information intermediaries, rather than establishing parallel training structures. Program design should accommodate collective learning practices aligned with local cultural norms, while intermediary organisations play a critical role in translating national pre-bunking frameworks into locally resonant content. Effective implementation ultimately requires coordination across institutional, organisational, and community levels.

The study has several limitations that should be acknowledged. The quasi-experimental component involved a small sample of 49 women in Jakarta, limiting generalizability and statistical power, and observed group differences cannot be attributed exclusively to the intervention due to potential external influences. Focus group settings may have introduced social desirability bias, and the pre-bunking analysis relied primarily on stakeholder interviews at the national level, which may not capture informal or regional initiatives. Future

research should examine how this community-based approach scales across diverse demographic groups and regions in Indonesia and conduct systematic comparisons with Western initiatives to identify transferable principles and culture-specific mechanisms of digital resilience.

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Conflict of Interests

The authors declare no conflict of interests.

Data Availability

Data supporting this study are openly available at https://doi.org/10.17632/9y56fnhkxk.1

LLMs Disclosure

Microsoft Copilot was used to assist with English translation, grammar refinement, and stylistic editing during manuscript preparation. All conceptual development, data interpretation, and final decisions regarding the content remain the sole responsibility of the authors.

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