

## Education on Islamic-Based Digital Financial Management to Prevent Illegal Loans And Fraudulent Investments among Generation Z

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**Abstract**

**Originality/novelty:** The study contributes a practical, values-based model that combines digital financial literacy with Islamic financial ethics to guide safer and more responsible financial behavior among youth.

**Objective:** The study aims to address Generation Z's limited understanding of digital financial risks by implementing an educational intervention that integrates digital financial literacy with Islamic financial ethics, aiming to improve youth digital financial awareness and responsible decision-making.

**Methods/approach:** The community-service program targeted Generation Z participants and was implemented through presentations, case-based discussions, and practical exercises. Evaluation was conducted using pre-test and post-test assessments to measure changes in understanding.

**Results:** Post-test scores reached 81.25%, reflecting a 32.5% increase compared to pre-test results. Participants demonstrated positive responses and enhanced critical thinking when evaluating legal and illegal financial services.

**Implications:** The program provides an effective educational framework for protecting youth from digital financial risks by reinforcing ethical and Islamic financial values, demonstrating the necessity of sustaining similar initiatives for Generation Z.

**Keywords:** Digital Financial Management; Islamic Values; Financial Literacy; Illegal Online Loans; Fraudulent Investment.

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## INTRODUCTION

The rapid acceleration of digital transformation in the modern era has fundamentally restructured contemporary lifestyles, reshaping how individuals interact, transact, and manage financial resources (Koskelainen et al., 2023) . Within this digital ecosystem, the proliferation of digital banking, online investment, application-based insurance, and diverse financial technology services has vastly expanded financial inclusion (Suryono et al., 2021) . While these technological advancements present valuable economic opportunities for streamlined transactions and wealth accumulation, they simultaneously create new demands for digital financial capability and safer personal money management, particularly among younger demographics such as Generation Z (Rahayu et al., 2026) .

Generation Z occupies a central position in this financial transition due to its high connectivity to smartphones, online platforms, and digitally mediated consumption and finance (Kesuma et al., 2025; Putri & Ishak, 2024) . However, high digital exposure does not inherently guarantee strong financial judgment. Empirical evidence indicates that younger cohorts continue to exhibit important literacy gaps, particularly regarding online loans, complex financial decision-making, and the secure use of fintech products (Mawarni & Hendrawaty, 2025) .

This rapid expansion of digital finance has been closely accompanied by persistent illegal online lending operations and increasingly sophisticated digital investment fraud (Purborini & Soraya, 2026) . Unauthorized lending platforms frequently exploit consumers through abusive interest structures, coercive debt collection practices, personal data misuse, extortion, threats, and defamation (Anita & Satyalalita, 2026) . The scale of this socio-economic threat is substantial, with regulatory authorities blocking tens of thousands of illicit fintech and investment entities over recent years (Purborini & Soraya, 2026) , alongside cumulative public losses reaching hundreds of trillions of rupiah due to fraudulent schemes and trading-robot scams (Kharisma, 2024) . Furthermore, fraudulent investment mechanisms have grown technologically adaptive, utilizing social media, online influencers, cryptocurrency-linked Ponzi structures, and deepfake deception to mimic legitimate trading platforms (Panggabean et al., 2025)

Generation Z appears especially vulnerable to these risks because fintech credit is easy to access, attractive to tech-savvy users, and frequently adopted before risk-management skills are fully established (Hendrawaty et al., 2022). Recent data reveal a high generational concentration of credit vulnerability, with young adults contributing significantly to non-performing digital loans and credit problems (Benediktus & Kohardinata, 2024). Consequently, contemporary literature treats digital financial literacy as a multidimensional capability that extends beyond basic budgeting to encompass technical navigation, transaction security evaluation, consumer protection awareness, and safer behavioral translation (Satria et al., 2022).

To address these vulnerabilities, educational responses must move beyond conventional, one-off informational campaigns. Evidence from community-based education consistently supports participatory, practice-oriented models anchored in problem-centered learning, guided practice, mentoring, and reflection (Susanti et al., 2026). Programs combining structured

discussions, simulations, and budgeting practice have successfully enhanced understanding of emergency planning, saving, and safer investment behavior (Nursaidah et al., 2026). Moreover, interventions grounded in Islamic finance provide a vital ethical framework centered on justice, sustainability, prudence, and moral responsibility, helping participants differentiate legitimate financial arrangements from predatory structures (Hasbiah et al., 2025).

Despite extensive recognition that digital financial literacy protects youth, empirical and practical frameworks evaluating localized, community-based interventions that simultaneously integrate digital risk verification, practical budgeting skills, and Islamic financial values in peripheral urban settings of Eastern Indonesia remain scarce. Although general scholarship establishes the importance of financial literacy, limited research evaluates how culturally contextualized, participatory intervention models perform among regional youth populations in areas like North Ternate City, where regional regulatory warnings highlight acute risk exposure.

Accordingly, this study aims to implement and evaluate a comprehensive community service program targeting Generation Z in the North Ternate District, focusing on digital financial management education alongside preventive strategies against illegal online lending and fraudulent investments. Specifically, this study addresses the following questions: How can an integrated intervention combining digital literacy and Islamic finance principles improve participants' financial risk perception? To what extent does practical budgeting instruction enhance basic financial management skills among regional youth? By utilizing a participatory and community-based educational design, this study contributes to the literature by providing an actionable, replicable intervention model for strengthening financial resilience and critical risk awareness among vulnerable digital natives in underserved regional contexts (Malinda et al., 2025).

## LITERATURE REVIEW

### Introduction and the Digital Financial Transformation

The rapid expansion of digital finance has fundamentally reorganized how young cohorts access payments, credit, savings, and investment products. Contemporary scholarship conceptualizes this shift not merely as a technological upgrade, but as a structural transformation of everyday financial behavior mediated through mobile platforms, app-based lending, digital investing, and algorithmically driven consumption ecologies (Koskelainen et al., 2023). In emerging market economies such as Indonesia, this transformation has dramatically widened financial inclusion, yet access has outpaced users' cognitive and risk-management capacities (Prihandini, 2025).

Consequently, digital financial literacy is increasingly defined as a multidimensional construct extending far beyond conventional financial knowledge. It encompasses operational proficiency, real-time product awareness, cybersecurity practices, and the critical ability to recognize and evade digital scams and fraud (Choung et al., 2023). This expanded capability is particularly vital for Generation Z, who operate within the most intensive zones of digital platform engagement and face constant exposure to app-based credit interfaces, peer-driven financial

content, and frictionless consumption mechanisms (Schöberl et al., 2022).

### **Empirical Evidence on Digital Financial Literacy and Credit Vulnerability**

Empirical research consistently demonstrates that technical familiarity does not reliably translate into prudent financial judgment. While studies indicate that digital financial literacy is positively associated with sound saving, spending, and investment behavior (Choung et al., 2023), a persistent competence gap remains. In Indonesia, for instance, financial inclusion is estimated at 80.51%, whereas digital financial literacy hovers around 54–56%, leaving a substantial cohort vulnerable to operational mismanagement (Harianto & Suciati, 2026). Over half of digital finance users fail to comprehend transaction terms and conditions, and many routinely compromise security credentials, signaling weak foundational awareness (Prihandini, 2025).

In the realm of digital credit, online loans and Buy-Now-Pay-Later (BNPL) services are engineered around speed, convenience, and low barriers to entry, disproportionately attracting young, liquidity-constrained consumers (Arraniri et al., 2025; Sekarlaras et al., 2025). Although some empirical models find that financial literacy and self-efficacy directly reduce risky credit behavior and default risk (Simanjuntak, 2025), other investigations report paradoxical or mixed associations, where higher literacy scores sometimes correlate with increased online loan usage due to familiarity rather than protective restraint (Wicaksono & Mintoyuwono, 2026; Zakaria et al., 2025). This divergence highlights that youth vulnerability cannot be reduced to a simple knowledge deficit; it is deeply embedded in digital consumption ecologies shaped by dark patterns, perceived usefulness, and affective marketing (Purno & Azizurrohman, 2026).

### **The Threat Environment: Illegal Lending and Investment Fraud**

Beyond excessive borrowing, the digital threat environment encompasses widespread illegal online lending and sophisticated investment fraud. Regulatory and legal analyses in Indonesia document that illegal lending operations utilize deceptive pricing, abusive collection practices, data misuse, and cyber-extortion, with cumulative figures showing over 10,890 illegal entities shut down between 2017 and mid-2024 (Pramesti et al., 2025; Purborini & Soraya, 2026). The harms extend far beyond monetary loss to severe non-financial victimization, including intimidation, reputational defamation, and acute psychological distress (Anita & Satyalalita, 2026; Ruhlessin et al., 2022).

Simultaneously, digital investment fraud has migrated toward hyper-professional websites, social media channels, and AI-driven deepfake technologies designed to manufacture artificial trust (Gambín et al., 2024; Muzammil et al., 2025). Empirical studies confirm that anti-fraud competence and scam recognition do not emerge from financial knowledge alone; rather, they require an integrated skill set combining financial literacy, digital/cybersecurity literacy, and systematic legality verification (Nugraha et al., 2026; Umar & Dalimunthe, 2024). Targeted community and university-level interventions demonstrate that teaching verification techniques significantly bolsters risk awareness and resilience against fraudulent schemes (Minhajuddin et al.,

2025).

### **Ethical Orientation and Educational Interventions**

The literature on Islamic financial literacy introduces an essential ethical dimension to the discourse. Scholars argue that Islamic financial values function as cognitive and moral safeguards, helping to weaken the influence of impulsiveness and consumerist attitudes on over-indebtedness (Nurchayati, 2025; Purno & Azizurrohman, 2026). However, qualitative evaluations caution that youth Islamic financial knowledge is frequently fragmented and overly normative, leaving young users unequipped to navigate complex digital shadow-banking contracts and data-privacy risks in practice (Ainiyah, 2024). Thus, ethical framing achieves protective efficacy only when integrated with digital verification skills and practical case-based learning.

Regarding educational interventions, meta-analytic and experimental evidence reveals that while financial education produces positive causal effects on knowledge and general behaviors, debt-related outcomes remain notoriously difficult to shift (Frisancho, 2022; Kaiser, 2021; Kaiser & Menkhoff, 2017). Effective youth interventions must move beyond abstract information delivery toward applied, confidence-building, and context-relevant formats where self-efficacy acts as a mediator for sustained behavioral change (Salas-Velasco, 2022).

## **METHODS**

### **Program Setting and Participants**

This community service program was conducted in the North Ternate area, Indonesia, targeting Generation Z youth. The program was implemented over a three-day mentoring scheme from 13 to 15 November 2025 by an academic team from the Department of Sharia Accounting, Faculty of Islamic Economics and Business (FEBI), State Islamic Institute of Ternate (IAIN Ternate).

### **Problems and Needs Assessment**

The initiative was developed to address specific challenges faced by young people in North Ternate regarding digital financial management. The community problem was identified using the Participatory Action Research (PAR) approach, which emphasizes active involvement between the implementing team and participants from problem identification through solution implementation. The selected intervention was deemed appropriate because it aligns with educational and transformative objectives, equipping Generation Z with the capacity to understand, manage, and avoid digital financial risks that conflict with Islamic values.

### **Intervention and Program Design**

The primary objective of the program was to improve digital financial literacy based on

Islamic values among Generation Z. The main activities involved a structured demonstration method, training, and mentoring focused on Islamic digital finance. The roles of the academic team included delivering educational content and facilitating mentoring sessions, while participants actively engaged in discussions and practical exercises.

### **Implementation Procedure**

The program implementation followed a systematic framework oriented toward empowerment and social change, structured as follows:

- a. Problem Identification: Engaging with participants to identify local challenges concerning digital finance and non-compliant Islamic financial practices.
- b. Preparation: Designing the curriculum, evaluation instruments, and scheduling the three-day mentoring program.
- c. Implementation: Executing the educational workshops and interactive mentoring sessions from 13 to 15 November 2025.
- d. Assistance/Mentoring: Providing guided support to help participants apply sound digital financial principles.
- e. Evaluation: Assessing knowledge acquisition and program effectiveness through comparative testing.

### **Evaluation Method**

The achievement of the program objectives was evaluated using a comparative evaluation design utilizing pre-test and post-test measures. An evaluation sheet containing specific questions related to the presented material was administered to participants. The pre-test measured participants' initial baseline level of understanding regarding digital finance and Islamic values prior to the intervention. The post-test measured improvement in understanding after the completion of the program. The assessment of the achievement of the PkM program's objectives was carried out using a comparative evaluation system, which compares the results of the pre-test and post-test. The assessment instrument used an evaluation sheet containing several questions related to the material presented. The pre-test results measured the participants' initial level of understanding, while the post-test results measured improvement in understanding after the program was completed. Table 1 presents the pre-test and post-test evaluation sheet.

**Table 1. Pre-test and Post-test Assessment Instrument**

| No. | Question | Answer Choices |
|-----|----------|----------------|
|-----|----------|----------------|

- 1 What is meant by digital financial literacy?
  - A. The ability to use social media wisely.
  - B. The ability to understand, use, and manage finances with the support of digital technology.
  - C. Skills in creating financial content on the internet.
  - D. Basic computer knowledge.
- 2 One of the main characteristics of illegal online lending is...
  - A. Being registered with OJK and AFPI.
  - B. Offering low interest rates and long tenors.
  - C. Requesting access to all personal data and issuing threats when borrowers fail to pay.
  - D. Being managed by an official banking institution.
- 3 In the Islamic perspective, online lending practices with high interest fall under the category of...
  - A. Gharar.
  - B. Riba.
  - C. Maysir.
  - D. Wakalah.
- 4 The principle of Hifzhul Maal in maqāṣid al-syarīah means...
  - A. Protecting wealth so that it is used for lawful purposes and not misused.
  - B. Maintaining bodily health.
  - C. Managing time efficiently.
  - D. Preserving social relationships.
- 5 One characteristic of fraudulent investments is...
  - A. Providing transparent financial reports.
  - B. Promising high returns without risks and operating without official authorization.
  - C. Being managed by a registered sharia institution.
  - D. Having a clear legal basis.
- 6 The concept of Gharar in Islamic economics means...
  - A. Uncertainty or speculation in transactions.
  - B. Excessive interest in loan transactions.
  - C. Gambling with money.
  - D. Profits gained through deception.
- 7 The main objective of personal financial management is...
  - A. Spending income as quickly as possible.
  - B. Organizing income and expenses to achieve long-term life goals.
  - C. Following high-risk investment trends.
  - D. Saving money without planning.
- 8 One form of applying Islamic values in digital finance is...
  - A. Investing in all platforms without checking their legality.
  - B. Avoiding transactions that contain riba, gharar, and maysir.
  - C. Using financial applications without sharia authorization.
  - D. Taking loans with low interest.
- 9 Generation Z is
  - A. Is unfamiliar with technology.

- |                                                                                              |                                                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>known as a generation that...</p>                                                         | <p>B. Has been highly connected to the digital world since childhood.<br/>C. Prefers face-to-face communication.<br/>D. Avoids using financial applications.</p>                                  |
| <p>10 If someone wants to verify the legality of a financial application, they should...</p> | <p>A. Ask friends on social media.<br/>B. Check the official list on the OJK or AFPI website.<br/>C. Try the application immediately.<br/>D. Follow advertisements appearing on the internet.</p> |
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## METHODS

This section should describe the data, the development of the model (if applicable), and the methods employed in the study, along with the scientific rationale for their selection. The research may adopt a quantitative approach, a qualitative approach, or a mixed-methods design, depending on the nature and objectives of the study.

For quantitative research, equations may be embedded within the text if they are simple, short, and not central to the discussion (for example,  $a = b/c$ ). More complex or principal equations should be displayed on separate lines and numbered sequentially. Equation numbers must be enclosed in parentheses and right-aligned. Authors are strongly encouraged to use Microsoft Word Equation Editor or MathType to prepare both in-text and display equations to ensure consistency and clarity. Equations are considered part of the sentence and should be punctuated accordingly. To apply the correct formatting, the “Equation” style should be selected, which sets the appropriate tab stop positions. Press the Tab key once to align the equation and press Tab again from the right side to place the equation number.

In qualitative or community-based research, authors may adopt recognized approaches such as Participatory Action Research (PAR), Community-Based Participatory Research (CBPR), Service-Learning (SL), or Asset-Based Community Development (ABCD). The selected method or combination of methods must be clearly described, including how they were implemented in the field and why they were considered appropriate for addressing the research objectives. Where relevant, authors are encouraged to include diagrams, protocols, or process models to enhance methodological transparency.

## RESULT AND DISCUSSION

**Table 2. Pre-Test and Post-Test Results of Participants**

| No | Pre-Test |                    | Post-Test |                    |
|----|----------|--------------------|-----------|--------------------|
|    | Correct  | Percentage Correct | Correct   | Percentage Correct |
| 1  | 6        | 60%                | 8         | 80%                |
| 2  | 5        | 50%                | 7         | 70%                |
| 3  | 4        | 40%                | 8         | 80%                |
| 4  | 6        | 60%                | 9         | 90%                |
| 5  | 3        | 30%                | 7         | 70%                |
| 6  | 5        | 50%                | 8         | 80%                |
| 7  | 6        | 60%                | 9         | 90%                |
| 8  | 4        | 40%                | 7         | 70%                |
| 9  | 3        | 30%                | 8         | 80%                |
| 10 | 6        | 60%                | 9         | 90%                |
| 11 | 5        | 50%                | 8         | 80%                |
| 12 | 4        | 40%                | 7         | 70%                |
| 13 | 3        | 30%                | 8         | 80%                |
| 14 | 6        | 60%                | 9         | 90%                |
| 15 | 5        | 50%                | 8         | 80%                |
| 16 | 4        | 40%                | 7         | 70%                |
| 17 | 3        | 30%                | 8         | 80%                |
| 18 | 5        | 50%                | 9         | 90%                |
| 19 | 6        | 60%                | 8         | 80%                |
| 20 | 4        | 40%                | 7         | 70%                |
| 21 | 3        | 30%                | 9         | 90%                |
| 22 | 6        | 60%                | 8         | 80%                |
| 23 | 5        | 50%                | 9         | 90%                |
| 24 | 4        | 40%                | 7         | 70%                |
| 25 | 6        | 60%                | 8         | 80%                |
| 26 | 3        | 30%                | 9         | 90%                |
| 27 | 5        | 50%                | 8         | 80%                |
| 28 | 4        | 40%                | 7         | 70%                |
| 29 | 6        | 60%                | 9         | 90%                |
| 30 | 3        | 30%                | 8         | 80%                |
| 31 | 5        | 50%                | 9         | 90%                |
| 32 | 4        | 40%                | 7         | 70%                |

Source: Analyzed from collected data

The educational program on Digital Financial Management Based on Islamic Values was

implemented to enhance digital financial literacy among Generation Z in North Ternate, focusing specifically on the prevention of illegal online loans and fraudulent investments. Table 2 shows the program's quantitative effectiveness, evaluated using a pre-test and post-test assessment administered to all 32 participants.

### **Pre-Test Performance**

Prior to the educational intervention, participants demonstrated a relatively low baseline of material mastery. The distribution of pre-test scores across the 32 participants was as follows:

**30% score:** 4 participants (12.5%)

**40% score:** 8 participants (25.0%)

**50% score:** 8 participants (25.0%)

**60% score:** 12 participants (37.5%)

The total weighted score for the pre-test was calculated as:

$$\text{Total Pre-Test Score} = (12 \times 60) + (8 \times 50) + (8 \times 40) + (4 \times 30) = 1,560$$

Dividing this by the total number of participants ( $N = 32$ ) yielded an average pre-test score of 48.75%. This confirms that before the intervention, participants possessed a limited baseline understanding of Islamic digital finance principles and the specific risks associated with illegal online lending and investment schemes. This baseline deficit is plausible because young people, while heavy users of digital media and financial services, frequently lack formal preparation in online financial risk management, fraud awareness, and provider verification.

### **Post-Test Performance**

Following the completion of the educational intervention, a substantial improvement was observed in participants' performance and comprehension. The distribution of post-test scores across the 32 participants was as follows:

- **70% score:** 8 participants (25.0%)
- **80% score:** 12 participants (37.5%)
- **90% score:** 12 participants (37.5%)

The total weighted score for the post-test was calculated as:

$$\text{Total Post-Test Score} = (8 \times 70) + (12 \times 80) + (12 \times 90) = 2,600$$

Dividing this by the total number of participants ( $N = 32$ ) yielded an average post-test score of 81.25%.

### **Overall Program Gain**

Comparing the pre-test and post-test averages reveals a notable upward shift in financial literacy. The average score increased from 48.75% to 81.25%, representing an absolute gain of 32.5%. This quantitative improvement demonstrates that the educational program successfully enhanced

participants' digital financial literacy in a meaningful way.

### **Interpretation of Findings and Pedagogical Mechanism**

The findings indicate that the educational intervention significantly enhanced the digital financial literacy of Generation Z participants in North Ternate, raising average performance from 48.75% to 81.25%. This result suggests that targeted interventions effectively bridge the initial knowledge gap observed in youth regarding digital risks. This outcome is consistent with evidence that school- and community-based financial education strengthens youth knowledge, confidence, and decision-making in modern digital financial environments (Andriani et al., 2025; Mancone et al., 2024).

From a pedagogical perspective, the mechanism driving this improvement lies in the use of interactive and contextual learning formats. Because Generation Z comprises active users of digital financial technology, interactive discussions and practice-oriented formats align closely with their digital habits, fostering deeper engagement (Amalina et al., 2025). Case-based discussions using real-life scenarios assisted learners in moving from abstract concepts to applied judgment—such as recognizing phishing, verifying providers, evaluating credit costs, and distinguishing legitimate from fraudulent offers (Britchenko, 2025). These results align with findings that interactive discussions improve adolescent understanding of illegal loan legality, OTP/phishing risks, and consumer protection (Nadia et al., 2026), while practice-oriented models improve Gen Z knowledge and participation in formal digital finance (Amalina et al., 2025). Furthermore, this mechanism is supported by evidence that higher financial and digital literacy are associated with stronger awareness of investment fraud, cyber threats, and illegal online loan risks among students and young adults (Umar & Dalimunthe, 2024).

### **Integration of Islamic Values and Behavioral Application**

A distinctive feature of this program was the integration of Islamic economic values as an ethical foundation for financial behavior. Beyond technical risk evaluation, the curriculum emphasized that financial management also carries moral obligations grounded in prudence, transparency, justice, and sharia compliance (Dewi, 2025; Izaty et al., 2024; Surahman et al., 2026). Islamic finance frames financial activity as extending beyond pure profit-seeking, evaluating behavior through fairness, moral responsibility, trustworthiness, and broader social benefit (Khandakar et al., 2025).

This ethical framing explains why integrating Islamic values helped participants translate technical knowledge into reflective personal planning. Prior interventions combining digital-risk education with muamalah or Islamic ethics similarly improved responsible spending attitudes, sharia awareness, and resistance to harmful online borrowing (Sukmaningrum et al., 2026). Guided by these principles, participants developed personal financial plans based on sharia tenets, ensuring theoretical knowledge could be independently applied to daily life.

### **Contributions and Practical Implications**

Taken together, the North Ternate findings support the broader conclusion that targeted digital financial literacy programs can protect vulnerable youth from fraud by combining technical knowledge with digital safety and behavioral awareness (Choung et al., 2023; Umar & Dalimunthe, 2024). They also substantiate a values-based prevention model; evidence from youth and pesantren settings shows that integrating legal literacy, scam recognition, self-control, and Islamic financial ethics improves safer digital financial behavior (Nadia et al., 2026). Practically, these findings provide empirical evidence that community service programs can successfully empower tech-savvy youth against predatory financial schemes by merging practical risk-mitigation training with normative ethical frameworks.

## **CONCLUSION**

This community service initiative demonstrates that integrating Islamic economic values into digital financial literacy education effectively enhances young people's understanding and critical evaluation of modern financial risks. The educational intervention yielded a substantial 32.5% improvement in participants' average test scores—rising from 48.75% to 81.25%—reflecting a meaningful transformation in financial literacy among Generation Z in North Ternate. By grounding financial management in core sharia principles such as avoiding *riba*, *gharar*, and *maysir*, alongside the principle of prudence (*ihtiyat*), participants developed the capacity to identify illegal online loans and fraudulent investment schemes.

These findings contribute a contextually relevant model for community-based educational programs, proving that combining digital literacy with ethical frameworks reinforces community resilience against harmful financial practices. Practically, the program offers a replicable framework for practitioners and community leaders aiming to protect youth within increasingly complex digital ecosystems. Future program implementations should consider expanding participant groups, establishing longer-term evaluations and continued mentoring, and replicating the intervention across other communities to ensure sustained behavioral impact.

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## **Conflict Of Interest**

The authors declare that there is no conflict of interest regarding the publication of this article.

## **AI Usage Statement**

The authors declare that AI tools were used solely for language editing, grammar checking,

and improving the clarity and readability of the manuscript. AI tools were not used to generate core research ideas, conduct substantive analysis, interpret data, or draw scholarly conclusions. The authors take full responsibility for the originality, accuracy, and academic integrity of the content.

### Author Contributions Statement

MR, AM, and HH contributed to the conceptualization, methodology, data collection, and analysis. SS, RR, and NS contributed to the literature review, interpretation of results, and manuscript drafting. All authors reviewed and approved the final version of the manuscript.

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