ISRG Journal of Arts, Humanities and Social Sciences (ISRGJAHSS)

OPEN ACCESS

ISRG PUBLISHERS

Abbreviated Key Title: ISRG J Arts Humanit Soc Sci

ISSN: 2583-7672 (Online)

Journal homepage: https://isrgpublishers.com/isrgjahss

Volume – IV Issue - V (September-October) 2026

Frequency: Bimonthly

Teaching Health in the Digital Age: Designing a Low-Cost Health Promotion Model for Teacher Education Students in Malaysia

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| **Received:** 25.08.2026 | **Accepted:** 31.08.2026 | **Published:** 01.09.2026

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Abstract

This study examines the design of a Low-Cost Digital Health Promotion Model for teacher education students in Malaysia. The study aims to demonstrate how participatory health communication, digital health literacy, and sustainable learning principles can be integrated into an accessible health promotion approach. The discussion describes a four-stage community engagement process involving Metaplan-based participatory brainstorming, interactive health literacy enhancement, low-cost digital technology training, and sustainable commitment. Findings highlight challenges involving digital health literacy, health misinformation, technological accessibility, privacy, and AI competency. The study further discusses the transformation of participants from health information recipients into digital health content creators and prospective health ambassadors through participation, co-creation, and ownership.

Keywords: Metaplan, Participatory Health Communication, Digital Health Literacy, Sustainable Learning Environment, Health Ambassadors.

INTRODUCTION

1. Digital Transformation and the Changing Landscape of Health Promotion

Digital transformation is reshaping health promotion by changing how health information is produced, accessed, interpreted, and acted upon. Rather than functioning merely as an additional communication channel, digital technology increasingly forms part of the infrastructure through which health-related knowledge and services are delivered. Mobile applications, internet-based platforms, artificial intelligence (AI), digital monitoring systems,

DOI: 10.5281/zenodo.22224246

and other connected technologies can expand opportunities for timely health information and support more active engagement with health management. Evidence from a multicountry analysis demonstrates that digital transformation is positively associated with public health outcomes, with particularly pronounced effects in low- and low-middle-income settings. These effects operate partly through improvements in human capital and the efficiency of health expenditure, suggesting that digital transformation can contribute not only to technological modernization but also to broader public health development (Cheng et al., 2026).

The significance of digital transformation, however, extends beyond the introduction of new technological tools. Digital health initiatives alter organizational processes, patterns of interaction, and expectations concerning accessibility, responsiveness, and participation. Recent evidence indicates that technologies such as AI, electronic health records, telemedicine, and wearable devices may improve operational efficiency, reduce resource wastage, and support more sustainable healthcare systems. At the same time, digital transformation introduces tensions involving implementation costs, privacy, data governance, technological readiness, and unequal access. Consequently, technological availability should not automatically be equated with meaningful health promotion. A sustainable digital health strategy requires alignment between technological capabilities, human competencies, organizational conditions, and the broader social and environmental context in which health interventions operate (Leivaditis & Sepetis, 2025).

This tension is particularly important when digital health promotion is designed for educational environments and resource-constrained contexts. Digitalization can potentially widen access to health information, but it can also reproduce existing inequalities when users lack adequate connectivity, infrastructure, digital competencies, or confidence in using technology. A systematic review of digital transformation in the Indian health sector identified infrastructure limitations, high installation and operating costs, data privacy and confidentiality, language barriers, user-related constraints, and ethical and legal concerns among the major implementation challenges. Such findings indicate that effective digital health promotion should be designed around feasibility and inclusiveness rather than technological sophistication alone. A low-cost model can therefore represent a strategic design choice that prioritizes accessibility, usability, and local capacity rather than treating expensive technology as a prerequisite for innovation (Inampudi et al., 2024).

2. Teacher Education Students as Future Health Ambassadors

Within this changing environment, teacher education students represent an important but comparatively underexplored group in digital health promotion. They are not merely future users of health information; they are prospective educators who will operate within environments where students, families, schools, and communities increasingly encounter health information through digital media. Their future professional responsibilities therefore extend beyond subject-specific teaching toward the development of supportive learning environments and responsible information practices. Positioning teacher education students as future health ambassadors requires attention to their ability to identify credible information, communicate health messages appropriately, use digital resources critically, and translate health knowledge into educationally meaningful activities. This role is consistent with the broader recognition that digital transformation should improve health for all while addressing digital determinants of health and inequalities in access to digital benefits (Vidal-Alaball et al., 2023).

The concept of the health ambassador also introduces an important shift from dissemination to empowerment. A future teacher who simply receives health information may remain dependent on external experts or institutional campaigns, whereas a digitally capable teacher can interpret information, create context-sensitive messages, and facilitate health-related conversations among learners. Digital environments provide opportunities for such participation because users can move between consuming, evaluating, producing, and sharing information. Research on digitalized health services similarly demonstrates that digital transformation can increase users' psychological empowerment and sense of control, while technological readiness strengthens this relationship. Although this evidence concerns patients rather than teacher education students, its underlying implication is relevant to educational settings: meaningful digital engagement depends not only on access to technology but also on users' capacity to exercise agency through that technology (Zhou et al., 2025).

For teacher education, this perspective suggests that digital health literacy should be approached as a professional capability rather than an isolated technical skill. Future teachers need to understand how digital information can influence perceptions, decisions, and everyday health practices, while also recognizing the risks associated with inaccurate or misleading content. Their preparation should therefore combine health knowledge, digital evaluation skills, communication competence, and responsible technology use. Such an approach can enable teacher education students to function as intermediaries between formal health knowledge and everyday educational experiences. Instead of positioning health promotion as a specialized activity conducted only by healthcare professionals, teacher preparation can contribute to a distributed model in which educators become capable participants in preventive health communication and community learning.

3. From Information Delivery to Sustainable Health Engagement

The emergence of digital platforms creates an opportunity to reconsider the conventional information-delivery model of health promotion. Traditional health education frequently emphasizes the transmission of messages from an expert or institution to an audience, with success often associated with the amount of information delivered. Digital environments make it possible to move beyond this linear structure by enabling interaction, feedback, continuous communication, and user-generated content. Digital transformation has also strengthened the capacity to collect and integrate information concerning social determinants of health, allowing health-related conditions to be understood through broader patterns rather than isolated individual characteristics. A systematic review by Liu et al. (2023) emphasizes that digital transformation has improved the accuracy and timeliness of public health management while creating new possibilities for measuring and understanding social determinants of health.

Sustainable health engagement therefore requires continuity beyond a single workshop, campaign, or information session. Engagement becomes more meaningful when participants can apply what they learn, communicate it to others, create relevant health content, and maintain interaction through accessible digital networks. This principle is particularly relevant to a low-cost

DOI: 10.5281/zenodo.22224246

health promotion model for teacher education students because sustainability depends on participants' ability to continue the process without requiring substantial external resources. The objective is consequently not simply to provide students with health information, but to develop their capacity to recognize problems, evaluate information, use accessible digital tools, co-create health messages, and assume ownership of subsequent activities. Such an approach positions digital health promotion as a participatory learning process in which technological simplicity becomes an advantage because it facilitates replication, autonomy, and continuity.

Taken together, digital transformation, teacher preparation, and sustainable engagement provide the conceptual foundation for designing a low-cost digital health promotion model for teacher education students in Malaysia. The model proposed in this book responds to the central challenge that digital health innovation must remain accessible while generating meaningful participation and sustained learning. Its orientation toward low-cost technologies is therefore not a compromise in technological quality but a deliberate strategy for reducing barriers to participation and increasing the possibility of replication. The model further recognizes that sustainable digital health promotion requires an integration of health literacy, digital literacy, participatory communication, and learner ownership. By connecting these dimensions, teacher education students can move from passive recipients of health information toward active contributors to healthier educational environments, while digital tools become instruments for sustained learning rather than ends in themselves.

COMMUNITY ENGAGEMENT METHOD: BUILDING HEALTH LITERACY THROUGH PARTICIPATION

The community engagement approach in this program was designed to position teacher education students as active participants in developing digital health promotion solutions. Rather than treating participants as passive recipients of health information, the method combined participatory problem identification, interactive health literacy enhancement, low-cost technology training, and collective commitment. This approach was grounded in Participatory Health Communication and Sustainable Learning Environment principles, emphasizing active involvement, collaboration, and continuity beyond the completion of the program.

1. Participatory Problem Mapping through Metaplan-Based Brainstorming

The first stage employed Metaplan-Based Participatory Brainstorming to identify health-related challenges from the participants' own perspectives. Students were invited to write their perceptions and experiences concerning common health problems, difficulties in accessing reliable health information, barriers to using technology for health education, challenges associated with developing appropriate technologies, and ideas for addressing these limitations in the future. The collected responses were subsequently grouped and discussed collaboratively to establish a shared map of priority issues.

This method provided an important foundation for the subsequent intervention because the program was constructed around problems identified by participants rather than assumptions imposed by facilitators. The process also encouraged individual reflection while creating opportunities for collective interpretation. Through clustering similar responses, participants could recognize that their experiences were connected to broader issues involving digital health literacy, misinformation, technological accessibility, privacy, and the responsible use of emerging technologies. The participatory process therefore functioned simultaneously as a diagnostic activity and as an initial learning experience.

2. Interactive Health Literacy Enhancement

The second stage focused on strengthening health literacy through interactive learning. Instead of relying exclusively on conventional lectures, the program incorporated discussions and case studies that encouraged participants to connect health concepts with practical situations. The learning content covered healthy lifestyles among university students, health misinformation, evidence-based considerations concerning renewable energy and health information technology, and digital health literacy. This structure enabled participants to examine health information critically while relating the material to their own experiences and future professional responsibilities.

The interactive format was particularly relevant because digital health literacy requires more than familiarity with digital devices. Participants need to understand how information is produced, evaluate its credibility, and determine how it can be communicated appropriately to different audiences. The discussion-based process encouraged participants to become active learners capable of questioning information and considering possible solutions. In this context, health literacy was developed not simply as the accumulation of knowledge but as a practical capacity for informed decision-making and responsible communication.

3. Low-Cost Digital Technology and Sustainable Commitment

The third stage translated learning into practical digital production. Participants were introduced to free or easily accessible technologies, including Canva Education and artificial intelligence tools such as ChatGPT, to develop digital health infographics. The production process required participants to consider the intended audience, communication channel, key health message, implementation strategy, and sustainability plan. This exercise demonstrated that health promotion content could be developed without substantial technological expenditure while still requiring deliberate communication planning.

The final component was the Sustainable Commitment Session, through which participants developed shared commitments and established digital communication networks for continuing health-information exchange after the PKM activity. This stage transformed the intervention from a short-term educational event into a foundation for continued engagement. The intended outcome was greater participant ownership, enabling students to continue applying their knowledge and digital competencies independently.

Overall, the three-stage approach created a progressive learning pathway: participants first identified problems, then developed understanding, and finally applied their knowledge through accessible digital technologies and collective commitment. This sequence supported the broader Low-Cost Digital Health Promotion Model by integrating participation, health literacy,

DOI: 10.5281/zenodo.22224246

digital capability, and sustainability into a coherent community engagement process.

RESULTS AND DISCUSSION

1. Mapping the Digital Health Challenges of Future Teachers

The participatory mapping conducted with teacher education students revealed that digital health promotion is shaped by a combination of literacy, technological, institutional, and psychosocial challenges. Participants identified difficulties in determining whether online health information was credible, concerns about health misinformation, unequal access to appropriate technologies, privacy issues, and uncertainty regarding the responsible use of artificial intelligence (AI). These findings suggest that access to digital information does not automatically translate into effective digital health literacy. For future teachers, the challenge is particularly consequential because their professional role will require them to interpret information and communicate it to younger learners. Contemporary health promotion therefore requires competencies that connect health knowledge with media literacy, critical evaluation, and responsible digital participation (Mendonça & de Sousa, 2025).

The findings also indicate that the rapid incorporation of digital technologies can create emotional and professional pressures for future educators. Participants' concerns regarding technology-related adaptation are consistent with evidence that the accelerated adoption of digital tools during and after the COVID-19 pandemic transformed teaching practices while generating psychological demands for educators. Technology can facilitate communication and learning, yet the requirement to continuously adapt to unfamiliar platforms, changing expectations, and digitally mediated interactions can increase stress when adequate preparation is absent. Consequently, digital health promotion initiatives should not assume that technology is inherently empowering. Training needs to consider users' confidence, workload, emotional readiness, and capacity to integrate digital tools into everyday educational practices rather than introducing technology as an additional burden.

Technology-related stress becomes particularly relevant when digital competencies are expected to coexist with professional responsibilities. Previous research on foreign-language teachers during the pandemic demonstrates that intensive exposure to new technologies can intersect with professional burnout, illustrating that technological innovation may generate unintended consequences when implementation exceeds users' preparedness. For teacher education students, this finding reinforces the importance of introducing digital health technologies through manageable, low-cost, and pedagogically meaningful activities. Rather than emphasizing the quantity of technological tools available, training should prioritize the ability to select appropriate tools, understand their limitations, and apply them purposefully. A low-cost approach can consequently reduce technological complexity while allowing students to develop confidence through practical experimentation and collaborative learning (Morska et al., 2022).

The mapping process further demonstrates that digital health challenges cannot be reduced to individual deficiencies. Institutional infrastructure, access to technological resources, training opportunities, teaching demands, student characteristics, and personal readiness interact to shape the effectiveness of digital education. Recent research examining digital classrooms highlights the multidimensional nature of implementation challenges, indicating that teachers' experiences are influenced by interconnected technological, institutional, pedagogical, and user-related factors. This perspective is important for the proposed model because it prevents digital health literacy from being treated solely as a skill that participants must acquire. Sustainable intervention design must simultaneously consider the environment in which those skills are expected to operate, including access, institutional support, usability, and opportunities for continued application after the intervention (Gupta & Goel, 2026).

Mental health constitutes another dimension of the digital health challenge identified through the activity. The increasing visibility of psychological concerns among students and educators demonstrates that health promotion in digital learning environments cannot be restricted to physical health or lifestyle information. Digital platforms can provide opportunities for counselling, psychological support, and communication, particularly when conventional services are difficult to access. However, their usefulness depends on appropriate implementation, user trust, privacy protection, and the availability of competent support systems. For teacher education students, awareness of digital mental health resources is therefore part of broader health literacy. Future teachers need to recognize not only health risks but also appropriate pathways for seeking assistance and directing others toward credible support services (Rakshit et al., 2025).

2. From Health Information Consumers to Digital Health Content Creators

The workshop activities demonstrated an important transition from consuming health information toward actively creating and communicating health messages. Participants did not merely receive information about healthy lifestyles, misinformation, and digital health literacy; they were encouraged to transform their understanding into visual health communication products and case-based solutions. This transition is significant because digital health environments increasingly depend on users' willingness to participate in information ecosystems. Research on consumers' willingness to share personal digital information for health-related purposes shows that participation in digital health is influenced by perceptions of usefulness, privacy, and the purposes for which information is collected and shared. Such findings underscore the importance of preparing future teachers to become responsible digital participants who understand both the benefits and risks of health information exchange (Grande et al., 2022).

Social media further strengthens the potential for teacher education students to become health content creators because digital networks allow health messages to circulate beyond formal educational settings. Social networking platforms can facilitate rapid communication, peer interaction, and dissemination of health-related knowledge, transforming users into participants in broader health communication processes. However, the same characteristics that make social networks powerful also create opportunities for inaccurate information to spread quickly. The implication for future teachers is that content creation must be accompanied by critical judgment: effective health communication requires attention to evidence, audience characteristics, language, platform conventions, and the potential consequences of sharing particular messages. Digital engagement therefore involves both communicative creativity and informational responsibility.

DOI: 10.5281/zenodo.22224246

The workshop's emphasis on producing infographics using accessible tools illustrates how low-cost digital technology can support this transition. Rather than requiring specialized software or expensive infrastructure, participants can use freely available platforms and AI-supported tools to translate health concepts into visually accessible messages. Nevertheless, the ability to produce attractive content should not be confused with the ability to produce trustworthy content. Research examining health advice from social media influencers shows that health-related content can have both beneficial and harmful effects depending on its credibility, presentation, and perceived authority. Future teachers therefore require content-creation competencies that combine visual communication with source evaluation and ethical communication. The objective is not simply to increase the amount of health content produced, but to improve its reliability and usefulness for intended audiences (Kaňková et al., 2024).

3. Participation, Ownership, and the Emergence of Health Ambassadors

Participation emerged as a central mechanism connecting knowledge acquisition with potential long-term engagement. Through Metaplan-based brainstorming, group discussion, case analysis, and digital content production, participants were positioned as contributors to the identification of problems and development of solutions rather than as passive recipients of predetermined messages. This participatory structure creates opportunities for ownership because participants can connect health promotion with their own experiences, priorities, and capabilities. Evidence from an ambassador-facilitated workplace health programme indicates that peer-based approaches can support health promotion by creating channels through which participants receive assistance, encouragement, and practical guidance from individuals embedded within their social environment. The principle is transferable to teacher education, where peer influence can become a resource for sustaining health-related practices (Bond et al., 2023).

The emergence of the health ambassador concept therefore represents a shift in the expected outcome of digital health education. The objective extends beyond improving individual knowledge toward developing participants' capacity to influence health practices within their future professional environments. A teacher who can identify credible information, design accessible health messages, use low-cost digital tools, and communicate with peers can function as a bridge between formal health knowledge and everyday educational practice. Such a role is particularly relevant in contexts where health professionals cannot continuously provide direct communication to every school community. The ambassador model distributes elements of health promotion capacity while retaining the importance of evidence, ethical communication, and appropriate referral. Participation consequently becomes a pathway through which individual learning can develop into collective health engagement.

Overall, the findings support the conceptual logic of the Low-Cost Digital Health Promotion Model by demonstrating that digital health promotion should be understood as a progression rather than a single educational event. Participants first identify health and information challenges, develop understanding through interactive learning, engage with accessible digital technologies, co-create health communication products, and gradually develop ownership of the resulting activities. This sequence responds to the limitations of one-way health education by connecting knowledge with practice and participation. The model's low-cost orientation is particularly relevant because digital health inequalities are influenced not only by whether technology exists but also by whether users can meaningfully access and use it. The resulting approach therefore places human capability, participation, and sustainability alongside technological innovation.

The transition from information consumers to health ambassadors also has implications for the sustainability of community engagement. A programme is less dependent on external facilitators when participants acquire the competencies and confidence required to continue communicating health information through existing digital networks. For teacher education students, this continuity can extend into their future classrooms, schools, and communities. The proposed model consequently treats ownership as an important bridge between short-term intervention and longer-term impact. Its contribution lies not in introducing sophisticated technology, but in combining accessible tools with participatory learning, critical digital literacy, health communication, and peer influence. Such integration provides a practical foundation for preparing future teachers to navigate the opportunities and risks of digital health while contributing actively to healthier learning environments.

THE LOW-COST DIGITAL HEALTH PROMOTION MODEL

The Low-Cost Digital Health Promotion Model was developed as the central conceptual output of the community engagement program for teacher education students in Malaysia. The model responds to a practical challenge: digital health promotion needs to be accessible enough for participants to use independently while remaining sufficiently structured to develop health literacy, digital competence, participation, and sustainability. The model therefore does not define innovation in terms of technological sophistication. Instead, it frames innovation as the capacity to connect accessible digital resources with a progressive learning process. The resulting model integrates five sequential stages—awareness, understanding, engagement, co-creation, and ownership—through which participants can move from recognizing health issues toward becoming active contributors to health promotion. This structure reflects the PKM's conceptual output and its stated novelty of integrating health literacy, digital literacy, and a sustainable learning environment.

1. The Five-Stage Transformation: Awareness to Ownership

The first stage, awareness, establishes the entry point for the model. Participants are encouraged to recognize health issues that are relevant to their everyday lives and future professional environments. Awareness is not limited to knowing that a particular health problem exists; it involves recognizing the relationship between health information, individual behavior, digital environments, and the quality of available evidence. This distinction is important because individuals increasingly encounter health information through digital channels where information quality can vary considerably. Digital health literacy consequently begins with the capacity to recognize information needs and identify the types of knowledge required for informed decisions. Research among adults demonstrates that digital health literacy is associated with educational and cognitive characteristics,

DOI: 10.5281/zenodo.22224246

emphasizing that the ability to navigate digital health environments involves more than basic access to technology (Borba et al., 2024).

The second stage, understanding, moves participants from recognition toward critical comprehension. At this point, participants examine how health information is generated, communicated, and interpreted through digital platforms. Understanding requires the ability to distinguish evidence-based information from misleading or incomplete claims and to consider the credibility of different sources. The stage is particularly important in a digital environment because health information is increasingly mediated by algorithms, online platforms, and automated technologies. Digital transformation has consequently expanded the meaning of health literacy by connecting conventional health knowledge with the competencies required to navigate digitally mediated information systems. The transformation of health literacy in digital environments requires adaptation to new forms of information access, communication, and technological interaction.

The third stage, engagement, represents the transition from knowing to doing. Participants begin applying health knowledge through discussion, case analysis, digital exploration, and practical problem-solving. Engagement is essential because knowledge alone does not guarantee meaningful behavioral or educational change. The relationship between health literacy, digital health literacy, and health-related quality of life suggests that literacy competencies can have implications beyond information processing, particularly when individuals are able to use knowledge and digital resources in ways that support their health-related decisions. In the proposed model, engagement therefore represents the point at which participants begin experimenting with the knowledge and technologies introduced during the program rather than merely receiving them (Georgantopoulos & Lamnisos, 2025).

The fourth stage, co-creation, extends engagement into collaborative production. Participants work together to transform health knowledge into practical communication products, including digital infographics and solutions to health-related problems under resource constraints. Co-creation changes the participant's position from learner to contributor because the output is produced through interaction between participants' experiences, health knowledge, communication strategies, and available digital tools. This approach is particularly relevant for multicultural and potentially disadvantaged learning environments, where standardized health messages may not adequately reflect users' needs. Community-oriented approaches to digital health literacy demonstrate the value of involving participants directly in learning activities and developing solutions that respond to their circumstances (Wrona et al., 2026).

The fifth stage, ownership, represents the intended culmination of the transformation. Ownership occurs when participants perceive themselves as capable of continuing health-promotion activities beyond the formal intervention. Rather than depending continuously on external facilitators, they can use accessible technologies to develop and distribute appropriate health information, collaborate with peers, and sustain communication networks. This stage is particularly important for teacher education because future teachers can transfer the competencies developed during training into classrooms and school communities. Ownership therefore transforms the intervention from a temporary educational activity into a potential source of continuing health-promotion capacity.

2. Integrating Health Literacy, Digital Literacy, and Sustainable Learning Environment

The strength of the model lies in the integration of three complementary dimensions: health literacy, digital literacy, and the Sustainable Learning Environment (SLE). Health literacy provides the substantive foundation by enabling participants to understand health concepts and make informed judgments. Digital literacy provides the operational and critical competencies needed to locate, evaluate, produce, and communicate information through digital technologies. The SLE provides the contextual structure through which these competencies can be practiced collaboratively and maintained over time. Rather than treating the three dimensions as independent learning outcomes, the model connects them within a continuous process of participation and application. Evidence from school-based digital health literacy education indicates that structured educational interventions can improve students' competencies when learning activities are deliberately designed around digital health needs (König et al., 2022).

The integration also changes the role of the educational institution. A learning environment becomes sustainable when health literacy is not confined to a single lesson or campaign but becomes embedded in routines, relationships, communication practices, and opportunities for continued learning. This principle is demonstrated by school-based health literacy programs in which teachers, students, parents, and school leaders participate in interconnected learning processes. Such programs show that health literacy can extend beyond individual learning and influence the wider educational community when implementation is co-designed and supported by local facilitators. For teacher education, this suggests that future teachers should be prepared not only to understand health information but also to create learning environments in which health literacy can be continuously practiced (Cruickshank et al., 2025).

The model consequently treats digital technology as an enabling layer rather than its central objective. Technology is valuable when it helps participants access information, collaborate, create communication materials, and maintain connections after the formal activity. This distinction prevents the model from becoming technology-driven at the expense of educational relevance. For teacher education students, the most useful digital tool is not necessarily the most advanced one; it is the tool that can be understood, operated, adapted, and integrated into future teaching practices. The model therefore prioritizes functional digital capability alongside critical judgment and collaborative learning.

3. Why Low-Cost Technology Matters for Sustainable Health Promotion

The low-cost principle constitutes a deliberate design strategy rather than a limitation of the program. Expensive technologies can create barriers related to procurement, maintenance, infrastructure, technical expertise, and institutional budgets. In contrast, freely available or inexpensive digital tools can lower the threshold for participation and allow users to continue applying acquired competencies after the intervention. This consideration is especially relevant when health promotion is intended to reach diverse educational communities with different levels of technological access. Evidence from digital health literacy interventions among multicultural children and adolescents

DOI: 10.5281/zenodo.22224246

demonstrates the importance of designing interventions that respond to users' characteristics and access conditions rather than assuming uniform technological capacity (Choi & Bang, 2026).

Affordability also contributes to scalability. A health promotion model that depends on specialized equipment may function effectively within a funded project but become difficult to reproduce when external resources disappear. By contrast, a model based on commonly accessible digital platforms can potentially be transferred across institutions with fewer financial and technical requirements. The emphasis on affordable, scalable, and sustainable health literacy education is supported by school-based evidence showing that programs can be expanded through online training and local facilitation while retaining community participation (Indriani et al., 2026). This principle reinforces the relevance of low-cost digital health promotion for teacher education, where participants can subsequently reproduce activities within their own educational contexts (Cruickshank et al., 2025).

Finally, low-cost technology strengthens the model's orientation toward autonomy. When participants can access the tools independently, the continuation of health promotion does not necessarily depend on additional funding or specialized technical assistance (Saputra et al., 2026). This creates a direct connection between affordability and ownership: reducing technological barriers increases the possibility that participants will continue creating, sharing, and discussing health information after the formal program concludes (Murti et al., 2026). Earlier work on low-cost computing infrastructure similarly emphasizes the importance of maintenance considerations in resource-constrained environments, demonstrating that sustainability depends not simply on acquiring technology but on ensuring that users and institutions can maintain and operate it over time (Nabiev et al., 2010).

The Low-Cost Digital Health Promotion Model therefore represents a shift from technology-centered intervention toward human-centered digital health capacity building (Permana et al., 2026). Its five-stage transformation provides a developmental pathway from awareness to ownership, while the integration of health literacy, digital literacy, and sustainable learning environment provides the conceptual architecture supporting that pathway (Hernita et al., 2026). Low-cost technology functions as the practical mechanism that makes the model accessible, replicable, and potentially sustainable (Cholifah et al., 2026). For teacher education students in Malaysia, the model offers a foundation for developing future educators who can critically interpret health information, create appropriate digital health messages, collaborate with peers, and sustain health-promotion activities within educational communities (Sihotang, Suhud, Handaru, 2025b).

CONCLUSION

1. From a PKM Intervention to a Replicable Health Promotion Model

The PKM activity demonstrates that digital health promotion can be developed through an accessible, participatory, and resource-conscious approach (Merina, Suhud, Sihotang, et al., 2026b). Rather than functioning solely as a short-term educational intervention, the program generated a conceptual Low-Cost Digital Health Promotion Model that connects problem identification, health literacy development, digital technology utilization, content creation, and sustainable commitment (Merina, Suhud, Sihotang, et al., 2026b). The model emerged from the actual engagement of teacher education students, allowing their perceived health challenges, technological concerns, and ideas to inform the intervention (Pertiwi et al., 2026). This process strengthens the practical relevance of the model because its components are connected to participants' experiences rather than imposed exclusively through predetermined instructional materials (Sihotang et al., 2025).

The model also offers potential for replication because it does not depend on sophisticated infrastructure or specialized technological equipment (Wibowo et al., 2026). Participants were introduced to accessible digital platforms, including Canva Education and AI-based tools, and used these resources to develop health-promotion infographics and address case-based problems (Sihotang & Hidir, 2022). The emphasis on affordability makes the approach adaptable to educational institutions with different levels of technological capacity (Sihotang, Suhud, Handaru, 2025a). Replication, however, should not mean mechanically reproducing the same activities in every setting (Sihotang et al., 2025). The model is better understood as a flexible framework whose core principles can be retained while the health topics, communication formats, target audiences, and digital tools are adjusted to local needs (Ilhamalimy et al., 2025).

2. Building Sustainable Health-Promotion Capacity Among Future Teachers

The most important contribution of the intervention lies in its potential to develop future teachers as active contributors to health promotion (Suhud, Unarto, Sugianto Sihotang, et al., 2026). Teacher education students occupy a strategic position because their future professional activities will place them in continuous contact with learners, families, and school communities (Suhud, Sihotang, Boonkaew, et al., 2026). Developing their health literacy and digital competencies can therefore extend the impact of the intervention beyond the participants themselves (Sihotang, Suhud, Handaru, et al., 2026). Instead of simply receiving health information, students were encouraged to identify problems, examine information, discuss possible solutions, produce digital materials, and consider strategies for continued implementation (Sihotang, Suhud, Handaru, et al., 2027).

This progression supports a shift from information consumption toward health-promotion capacity (Suhud, Nair, Chee Hoo, et al., 2026). Future teachers can potentially use accessible digital tools to communicate health messages, respond to emerging information needs, and encourage healthier practices within learning environments. The concept of ownership is particularly important in this processs (Suhud, Wolor, Sulistyowati, et al., 2025). Sustainable capacity requires participants to perceive themselves as capable of continuing activities independently rather than relying permanently on external facilitators. The Sustainable Commitment Session therefore provides an important bridge between the formal PKM intervention and possible future health-promotion activities through digital communication networks (Suhud, Sihotang, Chanthawong, et al., 2026).

The development of health ambassadors should consequently be viewed as a long-term educational objective rather than an immediate outcome that can be fully achieved through a single intervention (Suhud, Sihotang, Juliana, et al., 2026). The current activity establishes an initial foundation by strengthening participation, practical digital skills, and awareness of health-

DOI: 10.5281/zenodo.22224246

information challenges. Continued practice, institutional support, and opportunities to apply these competencies in authentic educational contexts will be necessary to consolidate the ambassadorial role (Suhud, Sihotang, Allan, et al., 2026).

3. Implications for Future Community Engagement

Future community engagement should build upon the participatory structure established by this PKM. Subsequent programs can begin with locally identified health concerns and use collaborative mapping to determine which issues require attention (Sihotang, Suhud, Reztrianti, et al., 2027). This approach allows interventions to remain responsive as health risks, digital platforms, student needs, and patterns of misinformation change (Suhud, Boonkaew, Sihotang, et al., 2025). Community engagement can also be expanded beyond the initial participant group by involving lecturers, school teachers, student organizations, community representatives, and other relevant stakeholders in developing and disseminating health content (Suhud, Allan, Hoo, et al., 2026).

Further implementation should also strengthen the sustainability mechanisms introduced through the program (Sihotang, Suhud, Handaru, et al., 2027). Digital communication networks can become spaces for continuing information exchange, collaborative content development, and peer learning after formal workshops have concluded (Sihotang, 2027). Future activities could progressively incorporate more systematic monitoring of participation, quality of digital health content, continuity of communication, and the extent to which participants apply their competencies in educational settings (Suhud, Caniago, Sihotang, et al., 2026). Such evaluation would provide stronger evidence regarding the model's longer-term effectiveness (Cholifah et al., 2027).

Ultimately, the Low-Cost Digital Health Promotion Model offers a practical pathway for connecting digital innovation with participatory health education (Suhud, Caniago, Sihotang, et al., 2026). Its central value lies not in the use of technology alone, but in how accessible technology is combined with health literacy, digital competence, collaborative learning, and participant ownership (Sihotang, Suhud, Handaru, et al., 2027). For teacher education students in Malaysia, this approach provides an initial platform for developing future educators who can contribute to healthier and more digitally responsible learning environments (Sihotang et al., 2027). Its broader potential will depend on continued adaptation, evaluation, and collaboration across educational and community contexts (Sihotang, 2026).

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