



Enhancing Scabies Prevention Knowledge in Boarding School Students through the BETRI Model for Health Promotion



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ABSTRACT

Aims This study aimed to develop the BETRI model in health promotion to increase knowledge of scabies prevention among students.

Materials & Methods This experimental research employed a research and development approach using the ADDIE (analysis, design, development, implementation, evaluation) framework. The analysis stage involved identifying needs, context, and relevant literature. The participants were students at boarding schools, specifically Pondok Pesantren Mambaul Ulum and SMAN Titian Teras in Jambi. In the small group trial, the study included ten students from each institution, while the field trial involved 120 students (60 students from each institution). The health promotion products developed included educational videos, posters, pocketbooks, and educational modules, which were validated by experts and tested in stages. In the evaluation stage, a pre-test-post-test one-group design was conducted using a paired t-test.

Findings The implementation of this model significantly improved students' knowledge, with a mean score increasing from 54.17 in the pre-test to 95.00 in the post-test ($p < 0.0001$). Additionally, the educational media designed was deemed interesting, easy to understand, and effective in enhancing students' awareness of the importance of personal hygiene and the prevention of scabies. This model was feasible for application in a boarding school environment as a preventive measure against scabies.

Conclusion The development of an ADDIE-based health promotion model successfully increases knowledge and behaviors related to scabies prevention among students.

Keywords Scabies; Health Education; Students; Knowledge

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[1] Factors Associated with Scabies Prevention Behavior among Students at the As' ad Olak ... [2] Prevalence of scabies in the Covid-19 pandemic period and determination ... [3] Review of scabies in ... [4] Scabies control: The forgotten role of personal ... [5] The epidemiology of scabies in an impoverished community in rural ... [6] Basic Environmental ... [7] The public health control of scabies: Priorities ... [8] Scabies in ... [9] Host immune responses to the itch mite, *Sarcoptes* ... [10] The epidemiology of scabies and impetigo in relation to demographic ... [11] Scabies and impetigo prevalence and risk factors in Fiji ... [12] Risk factors associated with scabies infestation among primary schoolchildren ... [13] Geneva: World Health ... [14] Seroprevalence of *sarcoptes scabiei* var *suis* infestation in swine ... [15] Why are they hard to treat? A preliminary survey to ... [16] Risk factors for scabies in school ... [17] An overview of clean and healthy living behavior practices ... [18] Risk factors for scabies among schoolchildren ... [19] Factors of personal hygiene habits and scabies symptoms at ... [20] Improving health behavior standard through modern ... [21] The relationship between the level of knowledge ... [22] The effectiveness of developing flipbook media ... [23] Development of inferential statistics teaching materials ... [24] Factors associated with scabies outbreaks in ... [25] Mobile care app development process: using the ADDIE ... [26] Storyboard tools for university and education ... [27] From storyboard to story: Animation ... [28] Storyboard development for interactive ... [29] Character education for environmental ... [30] Development of a mobile app for self-care against COVID-19 ... [31] The validity of interactive multimedia on metal ... [32] The development of e-partograph module as a learning platform ... [33] ADDIE model-based learning to improve ... [34] The effectiveness of designing and using a practical ... [35] Development of an E-module for educational evaluation course with a problem based ... [36] E-module in blended learning: Its impact on students' disaster preparedness and innovation ... [37] Development of a flipped classroom-based ...

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Introduction

Infectious diseases remain one of the primary challenges in public health, with environmental factors playing a crucial role in their emergence and spread [1-3]. Unsanitary, overcrowded, and health-compromising environments significantly increase the risk of various diseases [4, 5]. Government Regulation No. 66/2014 on Environmental Health highlights that environmental media (such as water, air, soil, food, and public facilities) can serve as pathways for substances or agents that cause health problems or diseases in humans [6]. This underscores the critical need for effective environmental management as a preventive measure against disease [7].

Globally, the rapid spread and potential for outbreaks make infectious diseases a significant public health concern [8, 9]. As outlined in Law No. 4 of 1984 on Communicable Diseases, illnesses, such as typhus, smallpox, cholera, and bubonic plague demand immediate intervention. Additionally, endemic diseases like malaria, tuberculosis, and trachoma are key targets of government eradication programs [10]. Environmental factors and community behaviors are often pivotal in the transmission of these diseases. Scabies, for instance, remains a global health issue closely linked to such determinants [11, 12].

Scabies is a highly contagious skin condition caused by an infestation of *Sarcoptes scabiei* mites. Affecting more than 200 million people worldwide at any given time, the disease has a particularly high prevalence in tropical regions and densely populated areas. According to the World Health Organization (WHO), scabies affects up to 71% of the population in some regions, with children and vulnerable groups, such as the elderly, being disproportionately impacted [13]. The disease is strongly associated with poor environmental hygiene and poverty, often marked by inadequate access to clean water and sanitation facilities [14, 15]. By addressing the environmental and behavioral factors that contribute to the spread of infectious diseases like scabies, public health initiatives can better target vulnerable populations and implement sustainable prevention strategies.

Living in crowded environments, such as boarding schools, prisons, and orphanages increases the risk of scabies transmission due to direct contact and the sharing of personal items. Habits, such as exchanging clothes, towels, and bedding are the main routes for spreading the disease. In addition, low knowledge about prevention and treatment further exacerbates the situation. Many individuals rely solely on traditional medicine or use ointments without an adequate understanding of effective preventive measures [16].

Islamic boarding schools (pesantren) face unique challenges that contribute to the high prevalence of scabies compared to other environments [17]. The communal lifestyle in pesantren, characterized by

shared sleeping spaces, clothing, and personal hygiene facilities, creates ideal conditions for scabies transmission. Limited access to clean water and inadequate sanitation further compounds the problem. Many students lack personal hygiene supplies such as soap, clean towels, and bedding, which increases their vulnerability to infestation. Additionally, the perception that scabies is a minor or inevitable condition in pesantren leads to a lack of urgency in seeking treatment or implementing preventive measures. The combination of these factors necessitates targeted interventions to improve hygiene practices and enhance disease prevention efforts in pesantren settings [18-20].

Several studies have shown that the level of community knowledge greatly influences the prevalence of scabies. Research by Abdillah [21] in Islamic boarding schools found that the low level of knowledge among students is directly proportional to the high number of scabies cases. Meanwhile, according to Setiaji & Fitriani [22], education using media, such as flipbooks, can increase students' knowledge and hygienic behavior, thereby reducing the prevalence of this disease. This underscores the importance of community-based health education programs to prevent the transmission of scabies.

Preliminary studies conducted at the Mambaul Ulum Islamic Boarding School in Jambi showed that many students have habits that increase the risk of scabies, such as using damp clothes and rarely changing bed linen. Most students also consider scabies to be a common disease in the pesantren environment, leading to a lack of concern about its prevention. These factors indicate the need for more effective interventions to increase students' awareness and knowledge about scabies and the importance of personal hygiene.

Based on this background, the main problem identified was the low level of knowledge and attitudes of students in boarding schools regarding scabies prevention efforts. Therefore, the development of an innovative and effective health promotion model was deemed a necessary solution to improve preventive behaviors against this disease. With the right educational approach, it is expected that the prevalence of scabies could be reduced, especially in high-risk environments such as boarding schools. This study aimed to develop the BETRI model in health promotion to increase knowledge of scabies prevention among students.

Materials and Methods

Design study

This experimental study, conducted in 2024, utilized a research and development (R&D) approach with the ADDIE framework (analysis, design, development, implementation, evaluation). This approach was designed to produce and test the effectiveness of a health promotion model aimed at

improving scabies prevention efforts in boarding schools. The ADDIE model was chosen because it is systematic and flexible, allowing for continuous evaluation and development to generate applicable and effective solutions. During the evaluation of the educational model, the researchers assessed its effectiveness using a pre-test-post-test one-group design.

Participants

The participants were students at boarding schools, specifically Pondok Pesantren Mambaul Ulum and SMAN Titian Teras in Jambi. In the small group trial, the study involved ten students from each institution, while the field trial was conducted with 120 students (60 students from each institution). Participants were selected through simple randomization based on the inclusion criteria, including students who are active, live in the dormitory, are willing to participate, and come from an environment with a high prevalence of scabies.

The majority of participants were aged between 16 and 18 years, which is the typical age range for high school students, with a smaller proportion aged 19-20, particularly in Pondok Pesantren Mambaul Ulum, where some students continue their religious studies beyond the conventional high school years. Both male and female students were included in the study, with SMAN Titian Teras having a relatively balanced gender ratio, while Pondok Pesantren Mambaul Ulum

had a higher proportion of male students. Most students had been living in the dormitory for at least one year, with some residing there for up to three years or more. Longer dormitory stays increased the likelihood of exposure to scabies due to shared living spaces, personal items, and hygiene practices.

Before the research was conducted, each participant was provided with a detailed explanation regarding the purpose, procedures, benefits, and potential risks of participating in the study. The informed consent process was implemented by giving participants a consent form, which had to be signed after they understood all the information provided. For participants under the age of 18, consent was also obtained from their parents or guardians. This ensures that participation in the study is voluntary and based on full understanding, while also maintaining ethical standards in the research.

In addition, the sample selection was conducted randomly using a simple random sampling method to minimize bias in the study. With this technique, every student who met the inclusion criteria had an equal chance of being selected as a respondent. This approach aimed to obtain results that are more representative and can be generalized to a broader population. The randomization process also reduces the possibility of selection bias, ensuring that the results are more objective and reflect the actual conditions of students living in dormitories.

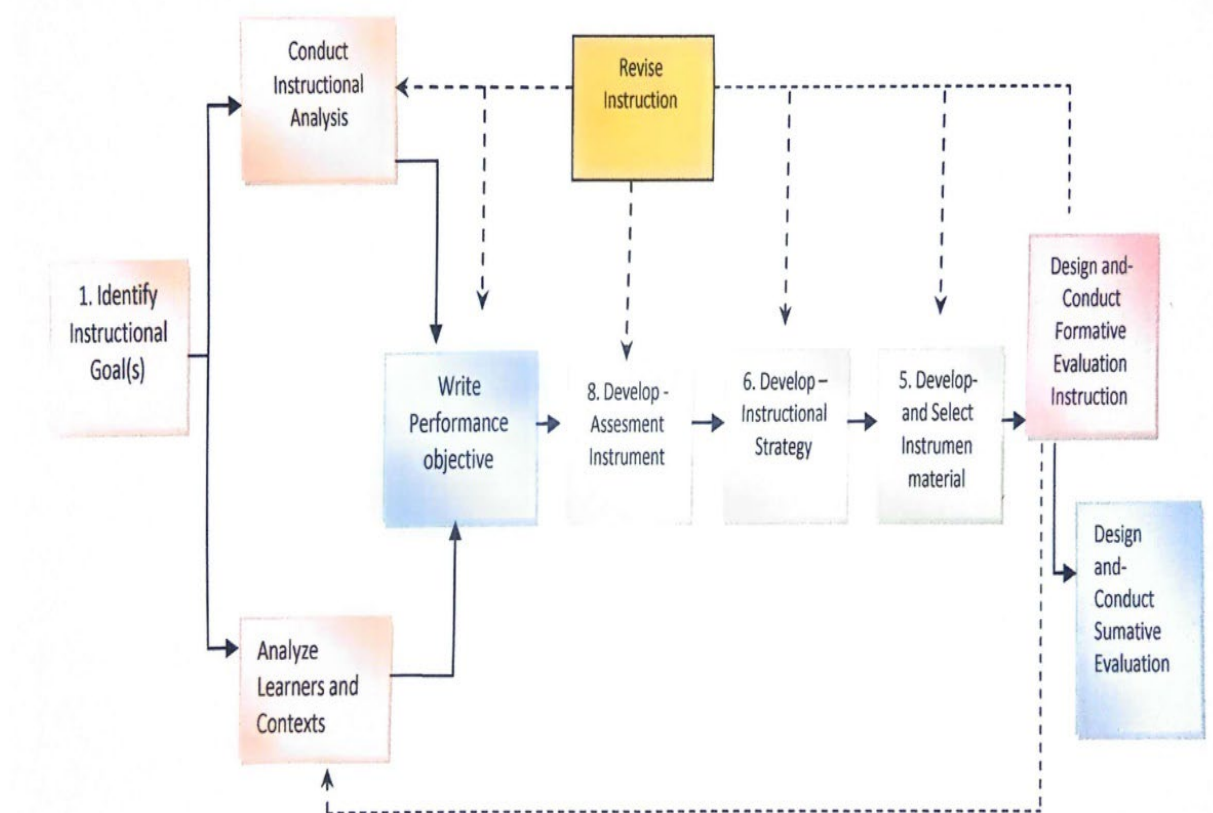


Figure 1. The used model

Procedure

This research was conducted through the five stages of the ADDIE model. The first stage is analysis, which includes needs analysis, context analysis, and literature analysis to understand the prevalence of scabies, risk factors, and educational needs. Next, the design stage involves creating a prototype of a health promotion model that includes educational media, such as videos, posters, pocket books, and model books. At the development stage, the prototype was further refined based on input from the initial analysis and validated by experts in the field of health promotion and skin diseases. The next stage is implementation, during which the prototype is tested on small groups and in field trials using a weak experimental design (pre-test-post-test one-group design). Finally, at the evaluation stage, a formative evaluation is conducted to identify weaknesses, revise the product, and ensure that the health promotion model meets the criteria for feasibility and effectiveness (Figure 1).

Parameters

The independent parameter was the health promotion model, which included educational media, intervention methods, and delivery strategies. The dependent parameters included knowledge about scabies, scabies prevention behavior, and scabies prevalence. Knowledge about scabies was measured using a questionnaire with a closed scale, where each correct answer received a score of one and each incorrect answer received a score of zero. The total score was then categorized into low, medium, and high knowledge levels. Scabies prevention behavior was measured with a Likert scale-based questionnaire, which included five rating levels ranging from strongly disagree to strongly agree. The total score was also categorized into low, medium, and high behavior levels. Meanwhile, the prevalence of scabies was measured through clinical observation by health workers, who recorded the number of cases before and after the intervention.

Prior to use, the questionnaires employed underwent validity and reliability testing. The validity test was conducted using item-total correlation analysis to ensure that each item was relevant to the construct being measured, while the reliability test used Cronbach's Alpha coefficient, with a value of ≥ 0.7 indicating good reliability. However, several question items in each variable did not meet the validity and reliability requirements, necessitating their replacement to ensure that the measurement results are more accurate.

Data analysis

Data analysis was conducted using both qualitative and quantitative approaches. Qualitative data were obtained through in-depth interviews, behavioral observations, and comments from experts, which were analyzed using spiral or Miles-Huberman techniques, as well as content and context analysis techniques. Meanwhile, quantitative data were

obtained from knowledge surveys, pre-test-post-test results, and questionnaires. Quantitative data analysis involved descriptive statistics to summarize the data, and inferential statistics, specifically the mean difference test (t-test), to assess the effectiveness of the health promotion model. Next, a Cohen's d test was conducted to determine the effect size of the difference in mean scores between the study groups. Data analysis was done using SPSS version 23.

Findings

In developing this health promotion model, several processes were carried out using the ADDIE framework, which included analysis, design, development, implementation, and evaluation and the results of the development procedure at each stage are described below.

1. Stage

At this stage, several analysis steps were conducted, including needs analysis, contextual analysis, and literature analysis. The following describes the stages of analysis in the development of a health promotion model for the prevention of scabies among students in boarding schools.

a. Needs analysis

Scabies is a common infectious skin disease in crowded environments, such as dormitories. Risk factors included poor personal hygiene, lack of education, and limited access to health facilities. The designed health promotion model aimed to raise awareness about personal hygiene, the importance of sanitation, and scabies control through community approaches, digital media, and school programs.

b. Contextual analysis

This analysis included stakeholders (pesantren/school residents), target groups (students), availability of facilities (educational media, infrastructure), organizational policies (lack of education and monitoring of healthy habits), and program feasibility. The results indicated the need to focus on scabies prevention through continuous education and awareness-raising.

c. Literature analysis

Scabies, caused by the *Sarcoptes scabiei* mite, is a global health problem with a high prevalence in at-risk environments. Prevention involved personal hygiene, environmental management, and education about the disease. In Indonesia, the prevalence of scabies is high, especially in dormitories and Islamic boarding schools, due to low knowledge and poor hygiene practices. Education, drug availability, and community-based counseling were key to controlling this disease.

2. Design stage

After the analysis, the researchers designed research products for the health promotion of scabies prevention among boarding school students. The products included educational videos, posters, a

pocketbook titled "Let's Prevent Scabies," and a health promotion model book. The initial stage involved creating a storyboard that outlined the sequence of images or activities in the educational video. This video included narration and supporting music, covering definitions, dangers, symptoms, causes, and prevention of scabies. Additionally, the design of the posters and pocketbook aimed to provide practical guidance for students to understand and prevent scabies.

3. Development phase

The development stage involved creating model books, educational videos, health posters, and pocketbooks as health promotion media for scabies prevention. After development, the products were validated by experts in material, concept, media design, and practitioners. Expert validation resulted in various suggestions related to the logic of the concept, consistency of theory, systematic presentation, and attractiveness of the media, which were then refined over several rounds until they were deemed suitable for testing. Practitioner validation involved teachers and boarding school caregivers, who provided high scores and stated that the product was very feasible for use. The next stage, a one-on-one trial with three students, demonstrated that the educational media were easy to use, engaging, and effective in conveying information. Furthermore, a small group trial with 25 students confirmed the effectiveness of the media and provided an opportunity for improvement before the field test stage. The developed products successfully increased students' enthusiasm, understanding, and awareness regarding scabies prevention.

4. Implementation stage (large group trial)

The next stage was the implementation stage, specifically the Large Group Trial, which is often referred to as a field trial. This trial was conducted with 51 students at Pondok Pesantren Mambaul Ulum in Jambi City and 39 students at SMAN Titian Teras in Jambi. The purpose of this large group trial stage was to assess the potential impact of using the health promotion model product on a larger number of participants and to evaluate its effectiveness in scabies prevention efforts. During this trial, the activities were led by the head of the boarding school and the vice student of the school, while the researcher acted as a resource person and observer. The implementation of this large group trial also aimed to test whether the product can be effectively utilized and to determine if it provides significant results in increasing knowledge and efforts to prevent scabies, particularly in a boarding school environment.

5. Evaluation stage

In the final stage of the research, a summative evaluation was conducted to thoroughly assess the impact of the application of the health promotion model and other supporting products implemented with students at Pondok Pesantren Mambaul Ulum

and SMAN Titian Teras in Jambi. The researchers used assessment tools in the form of pre-test and post-test sheets to measure knowledge and efforts to prevent scabies in boarding schools.

The evaluation employed a one-group pre-test-post-test design, which allowed for comparison of results before and after the implementation of the health promotion model. The results of the pre-test and post-test indicated significant improvements in various components of the assessment.

There was a significant improvement across all components measured. The respondents demonstrated a notable increase in their understanding of the ease of use of educational media, clarity of audio and visuals, clarity of educational material, and user attitude after the intervention. These findings suggest that the educational media was effective in enhancing the participants' comprehension and positive responses, reflecting an overall positive impact of the intervention (Table 1).

Table 1. Description of pre- and post-test results

Knowledge component	Number of respondents who answered correctly	
	Pre-test	Post-test
Ease of use of educational media	40(33.3)	85(70.8)
Audio and visual clarity	50(41.7)	90(75)
Clarity of educational materials	60(50)	80(66.7)
User attitude	45(37.5)	88(73.3)

The average knowledge score increased significantly from the pre-test (54.11 ± 7.17) to the post-test (95.00 ± 4.10), accompanied by a noticeable reduction in the variability of the scores. The statistical analysis confirmed that this improvement was highly significant, indicating that the health promotion model had a strong positive effect on students' knowledge ($p=0.0001$). Cohen's $d=6.99$ indicated that the intervention, or the difference between groups, is indeed large and has an extraordinary impact.

Discussion

This study aimed to develop the BETRI model in health promotion to increase knowledge of scabies prevention among students. The development of a health promotion model for the prevention of scabies in a boarding school environment was conducted by following the systematic stages outlined in the ADDIE framework. This approach ensures that every aspect of the health promotion model is appropriately designed to address the health challenges faced by students [23]. Each of these stages plays a crucial role in producing a product that is effective and efficient in preventing the spread of scabies in a boarding environment.

The first stage, analysis, served as an important foundation for the development of this health promotion model. At this stage, a needs analysis,

contextual analysis, and literature analysis were conducted to gain a deep understanding of the problems faced by the students. Scabies, an infectious skin disease that often occurs in densely populated environments, such as dormitories, urgently requires special attention. Risk factors such as poor personal hygiene and a lack of knowledge about how to prevent this disease necessitate a more intensive and structured approach. In the contextual analysis, it is essential to involve stakeholders, such as the school and caregivers, to support this health promotion program in a sustainable manner. The results from this stage suggest that prevention efforts should involve the entire community, with a focus on improved education, hygiene, and environmental control [7, 24].

At the design stage, the analyzed steps were transformed into health promotion products, including educational videos, posters, pocketbooks, and health promotion model books [25]. The educational video designed contained comprehensive content regarding the definition, dangers, symptoms, causes, and preventive measures for scabies. Using a storyboard, this video was crafted to provide visually appealing information, accompanied by a narrative that is easily understood by students [26-28]. Additionally, the poster and pocketbook are designed to offer practical information that can serve as a daily guide for students, thereby increasing their awareness of the importance of maintaining personal and environmental hygiene [29].

At the development stage, the designed products were tested and validated by experts in material, concepts, media design, and practitioners [30]. This validation process aimed to ensure that the developed products align with existing theories and are easily understood by the target audience, namely students. Expert validation provides crucial feedback, which is then refined through several rounds of revisions until the product is deemed suitable for testing. One-on-one trials conducted with three students demonstrated that the educational media were easy to use and captured students' attention. This indicates that the product has begun to be accepted by the target users.

The implementation stage, which is the large group trial stage, was conducted to measure the effectiveness of the product on a larger number of participants [31].

The trial took place in two locations, including Pondok Pesantren Mambaul Ulum and SMAN Titian Teras, involving a total of 90 students. In this trial, the researcher acted as a resource person, while teachers and caregivers served as observers. The pilot test provided a clear picture of the extent to which the health promotion product could be utilized on a wider scale. As a result, the product was well received by the students, and there was an increase in their understanding of scabies prevention.

Following the implementation, an evaluation phase was conducted to assess the impact of the health promotion model [32]. This evaluation employed pre-test and post-test instruments to measure the improvement in students' knowledge about scabies. Analysis of the pre-test and post-test results revealed a significant improvement in almost all aspects tested. For example, in the "Ease of Use of Educational Media" component, the percentage of students who answered correctly increased significantly from 40% to 85%. Additionally, in the "Clarity of Educational Materials" component, the results also improved from 60% to 80%. This increase indicates that the developed product has a positive impact on student understanding.

In addition, statistical analysis using the t-test revealed that the difference between the pre-test and post-test results was highly significant. This indicates that the implemented health promotion model had a strong influence on improving students' knowledge regarding scabies prevention. This increase in knowledge can motivate students to pay more attention to personal hygiene and their surrounding environment, which, in turn, will reduce the risk of scabies transmission in the dormitory setting.

In line with this research, Djojo *et al.* [33] reported a meaningful improvement in competencies among CNL through ADDIE model-based learning. Similarly, Alnajdi [34] noted the development of a rubric to evaluate classroom teachers' proficiency and effectiveness in incorporating drug prevention issues into teaching-learning situations, utilizing the five stages of the ADDIE Model. According to the study's findings, the ADDIE model can be employed to create evaluation instruments that assess teachers' proficiency and enhance their self-efficacy and teaching effectiveness in drug education in Malaysian secondary schools. Additionally, Hadi *et al.* [32] reported that the e-Partograph educational media, developed based on the ADDIE principles, demonstrates highly positive evaluation results. In terms of content, the e-Partograph is rated as appropriate (99.3), while from a media perspective, it is categorized as highly appropriate (195). The trial results also indicate its feasibility (101.6), and in user (student) trials, the e-Partograph is suitable (104.18). Therefore, it is recommended that the e-Partograph be implemented in the learning system. The development of this health promotion model demonstrated that an education-based approach, supported by engaging and easily accessible media, is highly effective in raising awareness about scabies prevention [35]. One of the key advantages of the developed educational media, particularly the e-module, is its flexibility in supporting independent learning [36]. This e-module enables students to access the material independently without relying on the presence of a teacher, making it an effective learning tool that can be used anytime and anywhere. Additionally, the e-module can serve as a temporary

substitute for educators in certain situations, such as when teachers or healthcare professionals are unavailable to provide direct education. With its interactive and structured format, the e-module helps students understand the material more easily and independently. This is highly beneficial in enhancing students' understanding and awareness of scabies prevention in a sustainable manner^[37].

The development of this health promotion model demonstrated that an education-based approach, supported by attractive and accessible media, is very effective in raising awareness about scabies prevention. Implementation that involves various parties, such as caregivers and teachers, along with gradual product testing, ensures that the resulting model can be well received by students. With the evaluation results indicating a significant increase in knowledge, this model has the potential to be applied more widely in other boarding schools as a more effective effort for scabies prevention.

This study utilized a systematic approach through the ADDIE framework, which facilitated the development of a structured health promotion model. The educational media developed, including videos, posters, and pocketbooks, were engaging and accessible to students, ensuring that the educational materials were well understood. Collaboration with various stakeholders, such as caregivers and teachers, ensured the relevance of the products to students' needs. Evaluation using pre-tests and post-tests demonstrated a significant increase in knowledge, illustrating the effectiveness of the model in raising students' awareness of scabies prevention. However, this study has some limitations. First, the sample size was limited to two locations, which may not be representative of broader conditions. Future research should involve a larger sample size to improve the generalizability of the findings and provide a more comprehensive understanding of the intervention's effectiveness. The short duration of implementation is also a limitation, as changes in students' hygiene behavior cannot be observed in the long term. Additionally, this study did not directly measure changes in hygiene behavior, which is an important factor in scabies prevention.

The process of developing a health promotion model for scabies prevention in boarding schools begins with a needs analysis based on health belief model (HBM) and social cognitive theory (SCT). This is followed by the design of the model and supporting products, along with expert and practitioner validation. Afterward, product trials and summative evaluations are conducted to assess the potential impact of the educational model. The procedure for using this promotion model follows the BETRI components, starting with problem identification, followed by in-depth evaluation, action, and continuous improvement. Field trial results indicate that the health promotion model effectively improves

students' knowledge, attitudes, and behaviors regarding scabies prevention.

Conclusion

The development of an ADDIE-based health promotion model successfully increases knowledge and behaviors related to scabies prevention among students

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