

DIGITALIZATION OF HEALTH EDUCATION FOR ADOLESCENTS THROUGH THE SIE MAHAT WEBSITE AS A STUNTING PREVENTION EFFORT IN BENUA PUHUN VILLAGE

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Abstrak: Berdasarkan survei kesehatan Indonesia, tingkat prevalensi *stunting* remaja untuk kategori umur remaja 16 hingga 18 tahun di Indonesia pada tahun 2023 adalah sebesar 20,1%. Salah satu upaya untuk menekan angka *stunting* tersebut adalah melalui edukasi dan penyediaan informasi kesehatan yang akurat melalui media digital. Desa Benua Puhun yang terletak di provinsi Kalimantan Timur merupakan salah satu desa yang memiliki potensi pemanfaatan media digital sebagai upaya edukasi *stunting* pada remaja. Kegiatan pengabdian ini bertujuan untuk meningkatkan pengetahuan remaja terhadap isu *stunting* melalui edukasi dan penyediaan informasi kesehatan digital. Metode yang digunakan dalam program mengadopsi pendekatan *Participatory Action Research* (PAR) yang mencakup tiga tahapan utama yaitu (1) persiapan, (2) pelaksanaan, dan (3) evaluasi. Hasil kegiatan pengabdian ini menunjukkan bahwa pelaksanaan edukasi melalui penyediaan informasi dan media digital SIE MAHAT dapat meningkatkan pengetahuan dan pemahaman mengenai permasalahan dan pencegahan stunting berdasarkan hasil $p\text{-value} < 0,05$. Remaja antusias dalam menggunakan media digital sebagai media edukasi dan informasi yang efektif dengan visualisasi yang menarik serta relevan. Kegiatan ini menjadi tonggak awal proses pemanfaatan media digital sebagai media pembelajaran dalam edukasi kesehatan stunting di Desa Benua Puhun.

Kata Kunci: digitalisasi, stunting, remaja, SIE MAHAT

Abstract: Based on the Indonesian health survey, the prevalence rate of stunting among adolescents aged 16 to 18 years in Indonesia in 2023 is 20.1%. One of the efforts to reduce this stunting rate is education and providing accurate health information via digital media. Benua Puhun Village, located in East Kalimantan Province, is one of the villages with the potential to utilize digital media to educate teenagers about stunting. This community service activity aims to increase teenagers' knowledge about the issue of stunting through education and the provision of digital health information. The method used in the program adopts a Participatory Action Research (PAR) approach that includes three main stages: (1) preparation, (2) implementation, and (3) evaluation. The results of this community service activity show that implementing education through information and digital media SIE MAHAT can increase knowledge and understanding of issues and prevention of stunting based on a p-value result of < 0.05 . Teenagers are enthusiastic about using digital media as an effective medium for education and information with attractive and relevant visualizations. This activity marks the beginning of utilizing digital media as a learning medium in health education (stunting) in Benua Puhun Village.

Keywords: digitalization, stunting, adolescents, SIE MAHAT

Introduction

According to the Regulation of the Minister of Health of the Republic of Indonesia No. 25 of 2014, adolescents are defined as individuals between the ages of 10 and 18 (Kementerian Kesehatan RI, 2024). On a global level, the United Nations Children's Fund (UNICEF) reported that the adolescent population reached approximately 1.3 billion in 2023 (UNICEF, 2024). In the same year, Indonesia's Central Statistics Agency recorded that adolescents constituted

15.86 percent of the national population, making this group the second largest demographic after early adults aged 20 to 39 (Witdiawati et al., 2024). Based on the 2023 Indonesian Health Survey (SKI), the prevalence of stunting among adolescents aged 13 to 15 years was 17.5 percent, while among those aged 16 to 18, it reached 20.1 percent. In East Kalimantan Province, the prevalence for the same respective age groups was 13.0 percent and 16.3 percent (Badan Kebijakan Pembangunan Kesehatan, 2024).

These figures underscore the importance of addressing nutritional problems during adolescence. Although stunting is commonly associated with early childhood, its long-term effects may persist into adolescence and adulthood if early interventions are not implemented. Adolescents who experience stunting often face barriers in physical growth and cognitive development, which may adversely affect their quality of life and productivity in later stages of life. Consequently, nutritional interventions should not be limited to early childhood but must be continued and strengthened throughout adolescence. Knowledge concerning nutrition and the prevention of stunting plays a crucial role in shaping adolescents' attitudes and behaviors toward early stunting prevention efforts. A strong and well-informed understanding of these issues may promote positive attitudes and encourage appropriate preventive actions, ultimately reducing stunting in the future (Witdiawati et al., 2024).

Despite increased access to digital platforms, many adolescents continue to face challenges in effectively utilizing digital media, particularly for accessing accurate and beneficial information. A study conducted by Mitchell Kapoor indicates that the younger generation is still not optimizing the use of digital platforms to seek knowledge and engage in self-development activities (Hasanah & Sukri, 2023). Although digital media offers vast and immediate access to information, limited digital literacy may lead to misunderstanding or misinterpretation. This condition reflects the tendency among adolescents to underutilize digital platforms as reliable sources of information. In reality, the internet has the potential to offer significantly greater value than mere entertainment, particularly in providing accessible information on disease symptoms, preventive measures, and health education (Hasyim, 2024).

Digital media as a tool for education is especially critical in rural areas, where access to conventional health education may be limited. Several rural communities have begun adopting digital platforms to disseminate important health information, including nutrition and stunting prevention materials. However, observations in Benua Puhun Village reveal that adolescents primarily use the internet for activities such as gaming and watching YouTube videos, often without realizing that the internet can serve as a valuable resource for broader educational and health-related purposes (Hasfani, Nirmala, & Hidayati, 2024).

This reality necessitates strategic interventions to increase adolescents' engagement with digital platforms in the context of health education. Several programs that have been implemented in rural settings include digital literacy campaigns, the use of educational video content, and the provision of website-based learning materials focused on stunting prevention. These initiatives serve not only to raise awareness of digital media's potential but also to empower communities to take informed and proactive measures to reduce stunting prevalence.

Benua Puhun Village has adequate educational infrastructure from elementary to senior

secondary levels. Nonetheless, interactive learning tools, particularly digital media as an educational and informative resource, remain underutilized. In response to this issue, the SIE MAHAT website (Sistem Informasi Edukasi Remajaku Sehat) was developed to enhance digital engagement among adolescents by providing accessible, visually engaging digital health education content aimed at stunting prevention. The research team designed and adapted the website which is publicly accessible at siemahat.com.

Methods

The implementation of the SIE MAHAT website employed the Participatory Action Research (PAR) method, which involved the active participation of students in understanding and practicing each feature of the website to access education and information related to stunting prevention during adolescence. Community service activities utilizing the PAR approach position the community not merely as passive recipients but as agents of change. This approach is also oriented toward fulfilling the needs and fostering the independence of these agents of change (Afandi et al., 2022).

This activity consisted of two stages: the delivery of educational material and the practical use of the SIE MAHAT website. The participants were 71 students in the twelfth grade at SMAN 02 Muara Kaman. The media used in this activity included a booklet containing information on stunting issues and prevention strategies during adolescence, as well as an educational video focusing on the dangers of cigarette smoke and the importance of balanced nutrition. These educational materials served as the primary content for the features provided on the SIE MAHAT website. A pre-test and post-test were administered to the participants using an online platform (Quizizz), consisting of 25 questions: 15 derived from the booklet and 10 from the video material. This activity aimed to enhance adolescents' knowledge regarding the implementation of stunting prevention from an early age, raise awareness of the determining factors contributing to stunting, and improve adolescents' skills in using digital media as an interactive educational tool for accessing relevant health information. The stages of implementation are illustrated in [Figure 1](#) and are described as follows:

- 1) Preparation: This stage involved conducting surveys and interviews with school personnel, including teachers, guidance counselors, and the principal of SMAN 02 Muara Kaman. Problem identification was carried out with a focus on the underutilization of digital media and the lack of educational content related to adolescent health, particularly stunting prevention. The student council and several teachers supported obtaining permission from the school. Problem-solving strategies were developed collaboratively through a Focus Group Discussion (FGD) involving representatives from the village government, health cadres, school personnel, and other local stakeholders. This collaborative planning led to the joint agreement on the activity's implementation.
- 2) Implementation: The educational session began with the delivery of material through the booklet. It was followed by an introduction to and practice with the features available on the SIE MAHAT website, with students directly engaging with each feature. The

session concluded with the presentation of educational videos addressing types of smokers, the dangers of cigarette smoke, and the importance of balanced nutrition. The pre-test was administered before any material was delivered, while the post-test was conducted after all sessions.

- 3) Evaluation: The evaluation aimed to assess the increase in students' knowledge before and after receiving the educational materials. The assessment also included active participation in practicing the website's features. Statistical testing of the knowledge improvement was conducted using the Wilcoxon test (non-parametric). The results were considered significant if ($p\text{-value} < 0.05$), indicating a measurable improvement in knowledge between the pre-test and post-test scores.

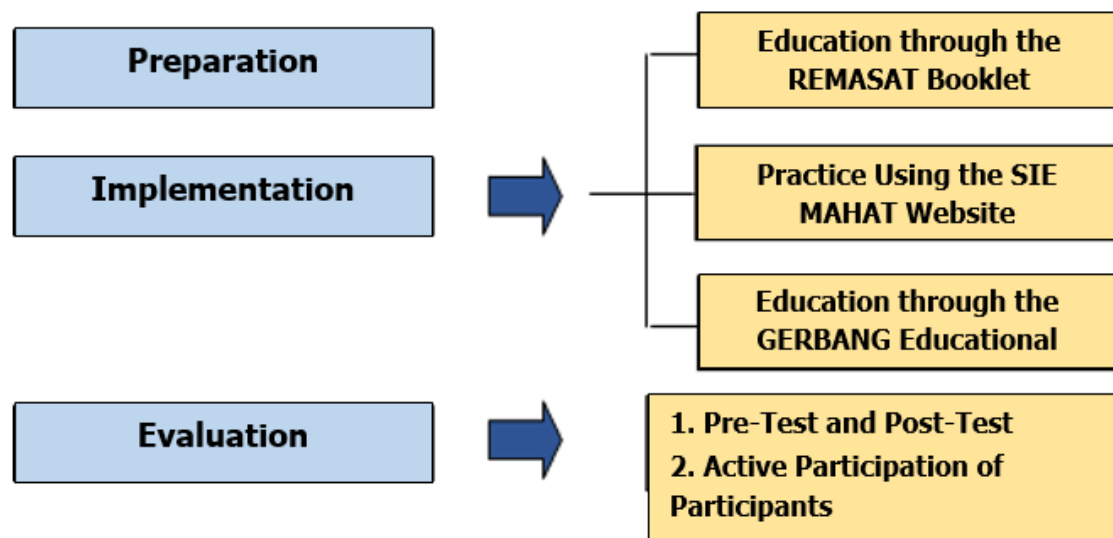


Figure 1. Implementation Scheme of the SIE MAHAT Website Utilization Activity

Result and Discussion

The implementation of the SIE MAHAT website comprised a series of structured educational activities focused on preventing stunting during adolescence. These activities involved using various learning media, including the REMASAT booklet, educational videos on the dangers of cigarette smoke and the importance of balanced nutrition, and the introduction and guided use of the features embedded within the SIE MAHAT website. Each of these activities is described as follows.

Educational Intervention through the REMASAT Booklet (*Remajaku Sehat, Stunting Lewat*)

The content presented in the REMASAT booklet includes an overview of stunting-related issues, a framework of contributing factors, the general condition and consequences of stunting, methods for assessing nutritional and stunting status, national intervention programs for accelerating stunting reduction, health-related Sustainable Development Goals (SDGs), the prevalence and prevention of anemia among adolescents, healthy lifestyle behaviors, and other supplementary health information. Overall, the booklet is an electronic learning medium

designed to support comprehension by presenting material in a visually engaging format (see Figure 2). This approach is intended to enhance systematic thinking skills in a simplified and accessible manner (Sopanda, Susiaty, & Hartono, 2023).

A study conducted by Astuti (2023) reported that using educational booklets effectively increased students' knowledge of stunting prevention. Similar findings were presented by Amelia and Sitoayu (2023), who demonstrated that both the knowledge and attitudes of female adolescents improved through booklet-based and audiovisual materials. Attractive and engaging educational media have enhanced adolescents' interest in health-related messages. For example, Ulfah and Aulia (2023) found that using booklets significantly improved adolescent girls' understanding of stunting prevention.

Using the REMASAT booklet in this program contributed to increased knowledge among students at SMAN 02 Muara Kaman regarding stunting-related issues. Participants clearly understood the material through active engagement in interactive discussions. The booklet's content, supported by visual illustrations, was well received by the students, as it facilitated their comprehension of key concepts related to stunting. Students actively asked questions about topics they had not yet fully understood and displayed enthusiasm when responding to the facilitator's prompts during each session.



Figure 2. (a) Delivery of material by the facilitator, and (b) Booklet media used as educational content available on the homepage of the SIE MAHAT website

Educational Intervention through the GERBANG (*Gerakan Remaja Bebas Asap Rokok dan Pemenuhan Gizi Seimbang*) Video

The GERBANG educational video comprises two main topics (the activity can be seen in Figure 3). The first addresses the concepts of active, passive, and third-hand smoke. This segment explains how both active and passive smokers are exposed to cigarette smoke and describes the health risks associated with third-hand smoke, particularly its impact on children and pregnant women. The second segment discusses the importance of balanced nutrition for adolescents as a preventive measure against stunting and to reduce maternal and child mortality rates. This material introduces the *Isi Piringku* (My Plate) concept, which replaces the outdated *4 Sehat 5 Sempurna* (Four Healthy, Five Perfect) framework.

The students expressed interest in the material presented through the educational videos,

as reflected in their active participation during the discussion. Several participants were curious about the concept of third-hand smoke, which was new to them. Additionally, many students reported that they had only recently become familiar with the *Isi Piringku* concept, having only known the older *4 Sehat 5 Sempurna* model. This report was evident from their responses during the discussion following the video presentation. The animated videos were thoughtfully designed to appeal to adolescents, with each lasting no more than two to three minutes. The brief duration and engaging visual format helped maintain student attention and made the educational content more accessible and enjoyable.

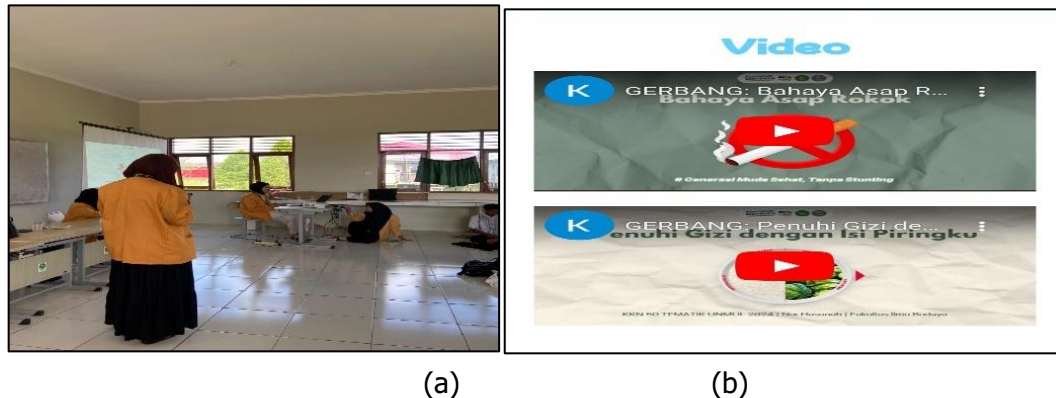


Figure 3. (a) Delivery of material by the facilitator, and (b) Video media used as educational content available on the homepage of the SIE MAHAT website

The influence of interactive health education on increasing adolescents' knowledge about stunting has been widely demonstrated, particularly through animated videos. For example, Maharani et al. (2022) found that the presentation of animated educational videos significantly improved adolescent girls' understanding of stunting. Similarly, the development of animated video media targeting adolescent girls to prevent stunting in newborns received highly positive responses from its target audience (Kurniawati et al., 2023).

Comparable findings were reported by Rusilanti et al. (2021), whose study revealed that digital video media effectively enhanced adolescent girls' knowledge about Adolescent Pregnancy Nutrition (APN) and stunting prevention. Moreover, an evaluation conducted by Nuraini et al. (2021) showed that health education videos significantly improved knowledge about stunting among women of reproductive age. As a form of audiovisual media, animated videos are an effective tool for increasing adolescents' knowledge and awareness of various health issues, including the dangers of cigarette smoke, the importance of balanced nutrition, and the prevention of stunting.

Table 1. Results of Pre-Test and Post-Test Scores Following Educational Intervention Using Booklet and Educational Video

Score of Knowledge	N	Mean	Min - Max	SD	<i>p-value</i>
Pre-Test	47	7165,96	1200 - 10300	2180,47	0,001
Post-Test	47	12800	6600 - 20400	3546,71	

Based on the data presented in Table 1, 47 participants were included in the analysis. The results indicate increased knowledge scores from the pre-test to the post-test following the educational intervention. This improvement is reflected in the rise in the mean knowledge score after participants engaged with the booklet and educational video materials. Normality testing revealed that the pre-test and post-test scores were not normally distributed (p -value < 0.05). Therefore, the Wilcoxon signed-rank test, a non-parametric alternative, was applied. The analysis yielded a statistically significant result with a p -value of 0.001 ($p < 0.05$), indicating a meaningful difference in participants' knowledge levels before and after the educational intervention using the booklet and video media.

Utilization of the SIE MAHAT (*Sistem Informasi & Edukasi Remajaku Sehat*) Website

The SIE MAHAT (Sistem Informasi & Edukasi Remajaku Sehat) website is a digital platform designed to deliver adolescent health education, specifically focusing on stunting prevention. The platform functions as a helpful health educational tool, offering high-quality content that aligns with current technological advancements and the community's evolving needs. It integrates a variety of health education components and provides several key features, including the following:

- 1) INFO PENTING! (*Informasi Pencegahan Stunting*) feature presents curated health-related news focusing on stunting issues at both the national and international levels. The content is directly linked to credible sources, such as articles published by recognized health institutions (see Figure 4).

During the introduction of the INFO PENTING! feature, participants responded positively. The feature was perceived as both interactive and easy to navigate. Its presented information enabled participants to easily access up-to-date, reliable health knowledge.

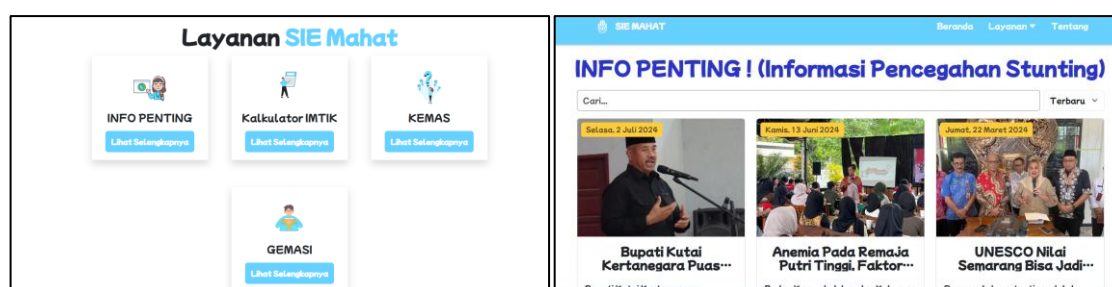


Figure 4. (a) Display of various features on the SIE MAHAT website homepage, and (b) Display of the INFO PENTING! Feature within the service section

- 2) IMTIK feature provides information about Body Mass Index (BMI) assessment results through a nutritional status calculator. Users can input their body weight, height, age, and gender to determine their BMI (see Figure 5).

During the explanation of the IMTIK calculator feature, participants reported that it was both engaging and valuable. The calculator simplifies the process of determining BMI and presents results in an easy-to-understand format. Participants responded enthusiastically, and even teachers during the program expressed interest and tried the feature.

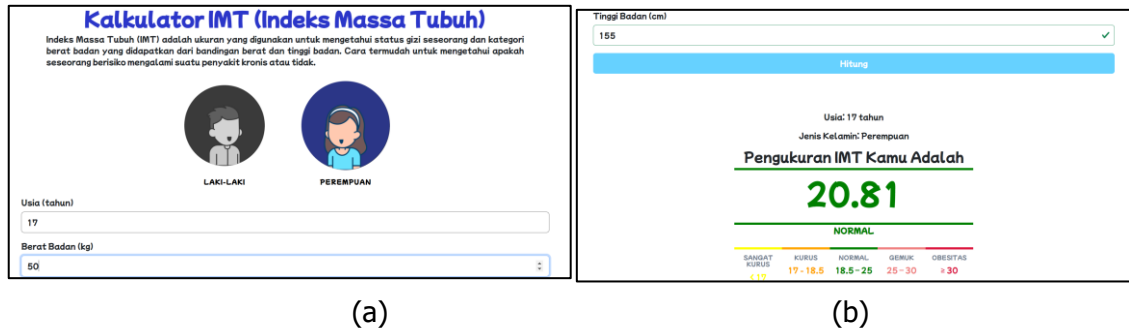


Figure 5. (a) Display the IMT feature within the service section, and (b) IMT measurement results completed by participants.

- 3) GEMASI (*Generasi Remaja Emas Berprestasi*) feature provides information related to the field of health education by showcasing works, products, articles, or scientific writings created by adolescents who have received recognition for their contributions to stunting prevention efforts. It highlights the outputs produced by these accomplished youths.

The GEMASI feature is intended to explore and promote the achievements of outstanding adolescents (see Figure 6). Some participants reported feeling motivated to engage in creative projects after viewing the displayed works. However, overall, participant responses indicated that interest and enthusiasm for using this feature remained relatively low, with many participants lacking ideas or initiative to create and contribute their works.

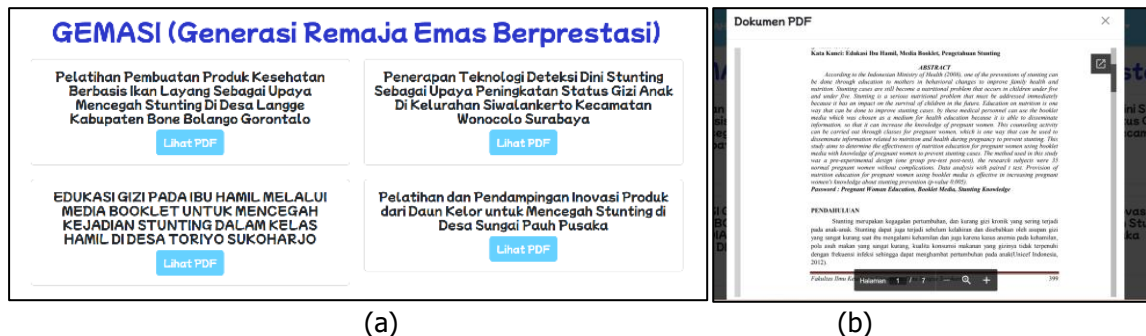


Figure 1. (a) Display of the GEMASI feature within the service section, and (b) Display of the "View PDF" option.

- 4) KEMAS (*Kuis Remaja Sehat*) feature is an interactive quiz game that contains questions related to the health topics covered in the platform's other features (see Figure 7). It is designed to make online learning more engaging and interactive while assessing adolescents' knowledge of health-related issues.

The quiz provides immediate feedback based on the number of correct answers: "Great" for five correct answers, "Good job" for three to four correct answers, and "Try again" for one to two correct answers.

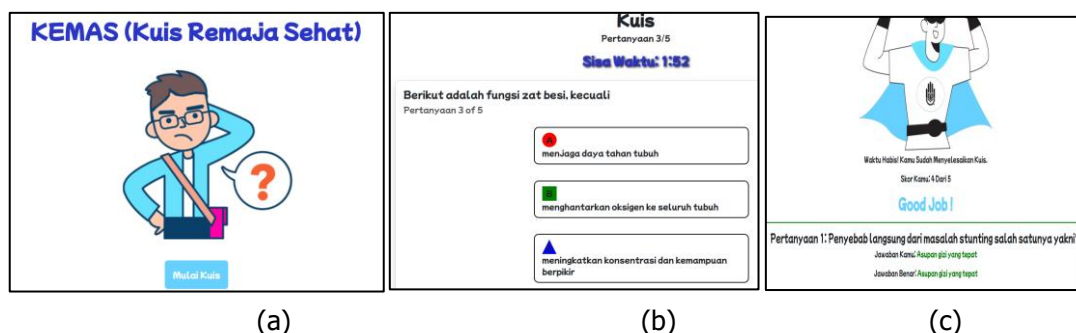


Figure 2. (a) Display of the KEMAS feature within the service section, (b) Display of timed question input, and (c) Quiz results display

Participants demonstrated positive outcomes in the interactive quiz activity, with an average score of 3 out of 5 questions answered correctly. The quiz was considered effective in assessing their understanding and making the learning process more engaging. Following the orientation session, participants conducted independent practice under the facilitator's guidance to ensure accurate comprehension. A question-and-answer session was held to clarify any remaining uncertainties and evaluate participants' experiences. This evaluation included feedback regarding their satisfaction with the training, the ease of using the feature, and the website's effectiveness in supporting the learning process.



Figure 3. (a) Initial homepage display on a smartphone, (b) Explanation of each feature by the facilitator, and (c) Adolescent participation

According to Andarwulan et al. (2020), using websites has been identified as a significant strategy in reducing stunting prevalence. The final implementation of the "Android-Based Stunting Service Information System" application was successfully developed and considered feasible to support stunting prevention efforts. This outcome affirms that technology-based educational platforms are effective and well-received by users (Resmiati et al., 2021).

Technology-based applications have shown a substantial impact in increasing public awareness and knowledge about health, with high levels of user satisfaction. They hold strong potential for broader adoption and adaptation in various contexts to improve public health (Pangestu & Afuan, 2021). Web-based technology is important in improving adolescents' knowledge and attitudes toward stunting. Its interactive and informative features and ease of access help adolescents better understand the medical, social, economic, and psychological dimensions of stunting (Wijaya & Annisa, 2023).

At SMAN 02 Muara Kaman, the use of educational media demonstrated significant progress as a learning tool, with high enthusiasm from both students and teachers in adopting digital technology. Observations revealed that 12th-grade students actively engaged with the website in classroom instruction. However, full-scale implementation of digital media across the school remains in the early stages, with some students and teachers only beginning to integrate technology into the teaching-learning process. Implementing the school website has improved information and communication management, administrative efficiency, and relationships between the school and the broader community (Kusumaningtyas et al., 2021). Similarly, Hadi et al. (2024) found that using interactive media applications could enhance teachers' pedagogical competence to support learning, while Ikawati et al. (2024) noted that Android-based instructional media could foster students' motivation to learn.

Despite these improvements, several infrastructural limitations persist at SMAN 02 Muara Kaman. Uneven distribution of digital devices and limited internet access hinder the optimal implementation of digital learning. The school is continuously improving technological infrastructure, including providing projectors and microphones and upgrading connectivity. However, the persistent limitations in device availability and internet access present key challenges that must be addressed to ensure widespread adoption of digital learning. These findings are supported by Styawati et al. (2021), who reported that digital media facilitates more interactive learning, with high satisfaction levels among teachers and students regarding its effectiveness in classroom instruction.

The development of educational media at SMAN 02 Muara Kaman indicates progress in integrating digital technology into learning activities. While media use has become more interactive, further improvement is needed to ensure full engagement from all students. Comparable developments are seen in other rural digitalization efforts. For instance, in Klatakan Village, establishing a village website improved access to information and self-service, although issues related to device availability and internet access remain (Ambarsari et al., 2024).

Interest among high school students in using digital media as a learning tool is relatively high. Nevertheless, device and internet limitations continue to prevent the full realization of its potential. At SMAN 02 Muara Kaman, the school has responded actively to digitalization, particularly in general and health-related education. Overall, while progress has been made, the success of digitalization in rural areas remains contingent upon improved infrastructure and sustained support from stakeholders (Nurqozin & Putra, 2023).

The school has shown a positive and supportive stance toward the integration of digital media in both general and health-related education. Digital learning implementation at SMAN 02 Muara Kaman has enhanced access to education anytime and from any location. This achievement indicates that digitalization has improved the efficiency of accessing information and self-service features online, thereby facilitating a more flexible and effective teaching and learning process (Widiyatmoko et al., 2022). Moreover, using information and communication technology (ICT)-based learning media can foster student creativity and active participation, although it also presents challenges such as technology misuse and limited access to web platforms (Widianto et al., 2021).

The implementation of the SIE MAHAT website has successfully improved students' understanding of the role of technology in supporting both health and education, particularly in the context of stunting prevention. Although infrastructural challenges, such as limited devices and internet access, persist, the enthusiasm shown by students and the support from school personnel highlight the potential for optimizing digital media use in educational settings.

Conclusion

The use of the SIE MAHAT website (Sistem Informasi dan Edukasi Remajaku Sehat), which provides informational and educational content through a booklet and animated video media, resulted in increased knowledge among students at SMAN 02 Muara Kaman, as evidenced by a Wilcoxon test with a p -value < 0.05 . Students demonstrated active participation through engagement in discussions, Q&A sessions, and hands-on practice with each feature of the SIE MAHAT website. This digitalization initiative aimed to enhance adolescents' interest and skills in utilizing digital media to disseminate health messages in an interactive and visually engaging format, particularly targeting adolescents as the key group in the early prevention of stunting. It is recommended that village and school authorities provide adequate facilities and infrastructure to support the digitalization process through internet access and digital media.

Acknowledgement

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