


Development of a Google Sites–Based Coronary Heart Disease Educational Media as an Outcome of Project-Based Learning

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Abstract: Education serves as a medium for acquiring knowledge, and along with the development of the modern era, learning has shifted from merely emphasizing content comprehension toward developing skills required to face real-world challenges. The integration of technology in education enables learning to be accessed anytime and anywhere. Classroom learning activities are conducted to achieve learning objectives; therefore, teachers may implement various innovative learning models such as Project-Based Learning (PjBL). PjBL encourages students to solve real-life problems through product development and has been proven effective in improving science problem-solving skills, particularly in biology learning related to health issues such as coronary heart disease. This study aims to develop a Google Sites–based learning media to provide information regarding the prevention of coronary heart disease. This study employed the 4D development model based on Sivasailam Thiagarajan (1974), this model consists of 4 stages: 1) define, 2) design, 3) develop, and 4) disseminate. The result of this study is an educational media entitled “Sehat Jantungku,” developed using Google Sites as a campaign media for the prevention of Coronary-Heart Disease (CHD). This media was disseminated online and promoted through Instagram and TikTok to reach a broader and more targeted audience.

Keywords: Google Site, Project-based Learning, Coronary Heart Disease, Educational Media

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Introduction

Learning is a process that facilitates individuals in acquiring knowledge and developing understanding. Along with the advancement of time, learning no longer focuses solely on content comprehension but also emphasizes the development of skills required for individuals to face real-world challenges. Life in the 21st century demands the mastery of various competencies, as education is expected to enable learners to actualize diverse forms of skills (Hamzah et al., 2023). Furthermore, 21st-century learning prepares younger generations to adapt to the rapid advancement of information and communication technology within society (Syahputra, 2018).

The 21st century is also characterized by the widespread integration of digital technology across various aspects of life, including the field of education. Learning through digital devices offers significant potential to transform education by expanding accessibility, increasing flexibility, encouraging interactivity and engagement, and supporting personalized learning experiences (Redhana, 2024). Consequently, teachers, students, and parents are expected to possess digital and media literacy skills, communicate effectively, think critically, solve problems, and collaborate efficiently (Fu’ad et al., 2022).

The rapid and widespread advancement of technology has encouraged both teachers and students to utilize it as a tool to support the learning process in the classroom. The implementation of technology in education is undoubtedly beneficial, as it provides teachers with access to a wide variety of learning media resources. However, technology must be appropriately integrated into learning activities in order to effectively achieve learning objectives (Nadila, 2024). To achieve these objectives, teachers may employ various learning models, one of which is Project-Based Learning (PjBL). PjBL is a learning model that positions students as the central subjects of learning and emphasizes a learning process that culminates in the creation of a product (Nababan et al., 2023). Furthermore, PjBL fosters curiosity as the driving force of learning, encouraging students to ask questions, conduct research, and design investigations or inquiries (Krauss & Boss, 2013).

The Project-Based Learning (PjBL) model was implemented in the Applied Physiology course. Through the application of PjBL, students were encouraged to identify problems occurring in Indonesia and provide solutions by developing a product. Applied Physiology studies the physiological processes occurring in living organisms, including plants, animals, and humans. The issue addressed in this study was Coronary Heart Disease (CHD).

Coronary Heart Disease (CHD) occurs due to the accumulation of plaque in the coronary arteries that supply oxygen to the heart muscles. According to the World Health Organization (WHO), cardiovascular diseases are the leading cause of death worldwide. Deaths caused by CHD are projected to increase to 25 million globally by 2030. In Indonesia, the prevalence of CHD continues to rise, closely associated with unhealthy lifestyle patterns (Wahidah &

Harahap, 2021). Heart disease in Indonesia affects approximately 1.5% of the population across all age groups, indicating that among every 100 individuals, 1.5 suffer from heart disease (Tampubolon et al., 2023). Research conducted by Rachmawati et al., (2021) also demonstrated that hypertension, diabetes mellitus, and physical activity are significantly associated with the incidence of CHD.

Coronary Heart Disease (CHD) has therefore become an important issue that requires preventive solutions and educational efforts. One approach that can be implemented is health education through Google Sites-based media. Google Sites is flexible, user-friendly, efficient in internet data usage, and compatible with mobile phone memory capacity. The rapid development of technology also requires educators to continuously innovate in the development of learning media (Islanda & Darmawan, 2023).

As previously mentioned, in the 21st century, the rapid advancement of digital technology has transformed the way information is accessed and disseminated, including in the field of health education (Rizvi, 2022). Therefore, the utilization of Google Sites as a health educational medium or has become increasingly important due to its accessibility, flexibility, and user-friendly features. Google Sites enables educational content to be accessed anytime and anywhere through various digital devices, making it highly suitable for modern society, particularly adolescents and young adults who are closely connected to internet and social media usage. In addition, Google Sites supports the integration of multimedia elements such as images, videos, hyperlinks, and interactive content, which can enhance user engagement and facilitate a better understanding of particular topic (Culajara, 2022; Halim & Halim, 2024). As a web-based platform that is easy to develop and operate without requiring advanced programming skills, Google Sites also provides educators with an innovative and cost-effective medium for delivering educational content, such as accurate and reliable health information, to a broader audience (Mustofa et al., 2024; Septiana & Anggreni, 2023).

Based on these considerations, the objective of this study was to develop a Google Sites-based learning media product aimed at providing education regarding the prevention of CHD.

Methods

This study was conducted in 2024 over the course of one academic semester in the Master's Program of Biology Education at Universitas Negeri Malang and involved a general practitioner and a nutritionist as resource persons, an Physiology lecturer as the subject matter expert, and 16 master's students in biology education as prospective users in the trial phase. The product "Sehat Jantungku" was developed using the 4D development model proposed by Sivasailam Thiagarajan, which consists of four stages: define, design, develop, and disseminate (Thiagarajan, 1974). Each stage describes a systematic process in the development of the Google Sites-based educational media.

The define stage focuses on preliminary study to identify the learning needs, analyze the problems, and determine the objectives of the media development. The design stage involves planning the structure, content, and visual appearance of the Google Sites platform. The develop stage includes the process of collecting the data through interviews and literature reviews along with creating, revising, and validating the media to ensure its feasibility and effectiveness. Finally, the disseminate stage aims to distribute and promote the developed media to a wider audience so that it can be effectively utilized as an educational tool.

The methods used to collect data included interviews with experts, a medical doctor (general practitioner) and a nutritionist, supported by literature studies from valid and relevant sources. The interviews were conducted to gather information regarding existing problems and to obtain accurate content materials for the Google Sites media. The list of interview questions for the general practitioner and nutritionist is presented in Table 1 and Table 2. Before being published and distributed, the "Sehat Jantungku" Google Sites platform underwent a validation process by subject matter experts, as well as a readability assessment by 16 master's students in biology education. The target users of this educational media were the general public and students at various educational levels.

Table 1. Question Items for General Practitioner

No.	Question Items
A.	General Questions
1.	What is actually meant by Coronary Heart Disease (CHD)?
2.	Among older adults, adults, and adolescents, which group is more at risk of developing CHD, and why does this occur?
3.	What are the main risk factors contributing to the development of CHD?
4.	Can CHD be inherited genetically?
B.	The Influence of Lifestyle
5.	Is there a significant relationship between lifestyle patterns and CHD?
6.	How do lifestyle patterns influence an individual's risk or likelihood of developing CHD?

7.	In today's era, unhealthy lifestyles among adolescents and young adults have become increasingly common. In your opinion, which unhealthy lifestyle habit has the greatest negative impact and the highest potential to trigger CHD?
C.	Coffee Consumption
8.	Can excessive coffee consumption among adolescents increase the risk of CHD? How can coffee contribute to this effect?
9.	What happens to the body, particularly the heart, when a person continuously consumes coffee over a long period of time?
10.	Are there any healthier alternatives to coffee that are suitable for regular consumption?
D.	Staying Up Late and Stress
11.	Can staying up late and stress increase the risk of CHD?
12.	What is the correlation between CHD and the habit of staying up late among adolescents?
13.	How can stress contribute to the development of CHD?
E.	Smoking
14.	How can smoking contribute to the development of CHD?
15.	Is it true that adolescents can consume candy as a substitute for smoking? How is this related to the risk of CHD?
F.	Exercise
16.	How does a lack of exercise or physical activity influence the risk of developing CHD?
17.	What is the recommended amount or intensity of exercise to help prevent CHD, particularly among adolescents?
G.	Diet
18.	Is there a relationship between poor dietary patterns and the risk of developing CHD?
19.	What types of foods can increase the risk of CHD?
20.	What kinds of dietary patterns can trigger the development of CHD?
H.	Preventive Measures
21.	Are there any specific tests or medical examinations that can be performed to detect an individual's risk of developing CHD?
22.	Are there any particular lifestyle changes that can help prevent the development of CHD?
23.	Are there other factors that contribute to the risk of CHD?
24.	Are there any specific measures that can be taken to reduce the risk of CHD?
25.	What kinds of preventive actions can be implemented to reduce the risk of CHD?

Table 2. Question Items for Nutritionist

No.	Question Items
1.	Can a healthy and balanced diet help prevent certain health problems?
2.	Can an unbalanced nutritional intake from food increase the risk of Coronary Heart Disease (CHD)?
3.	Nowadays, adolescents frequently consume coffee. Can excessive coffee consumption actually trigger certain diseases in adolescents, such as CHD?
4.	What is the appropriate portion or amount of coffee consumption to reduce the risk of developing diseases?
5.	Are there any healthier alternatives to coffee that are suitable for adolescents?
6.	Smoking has become increasingly common among adolescents, even though it is harmful both to smokers and to those exposed to secondhand smoke. Are there any alternatives or practical tips that can help adolescents avoid smoking?
7.	What type of dietary pattern can help prevent heart disease?
8.	What kinds of foods should adolescents avoid in order to reduce the risk of CHD?

Results

The validation results indicated that the media was categorized as highly valid and feasible for use without misinformation, with only several minor revisions suggested, such as the addition of supporting references and illustrative images. In addition, the readability results showed that the developed media was considered attractive, engaging, easy to access and operate, and contained useful information. The results of the interviews were summarized and organized into the Google Sites platform in accordance with the selected theme and design. Furthermore, the interview video or records can be directly accessed by users through embedded links provided within the platform. The results of the Google Sites development are presented in Figure 1, Figure 2, Figure 3, and Figure 4, also can be accessed directly through the following link: <https://sites.google.com/students.um.ac.id/sehatjantungku?usp=sharing>.

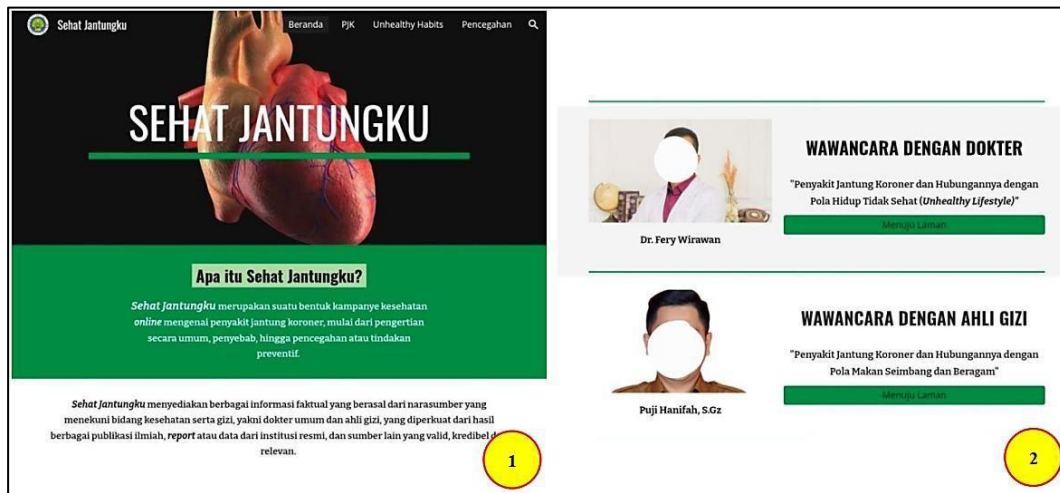


Figure 1. Home Menu

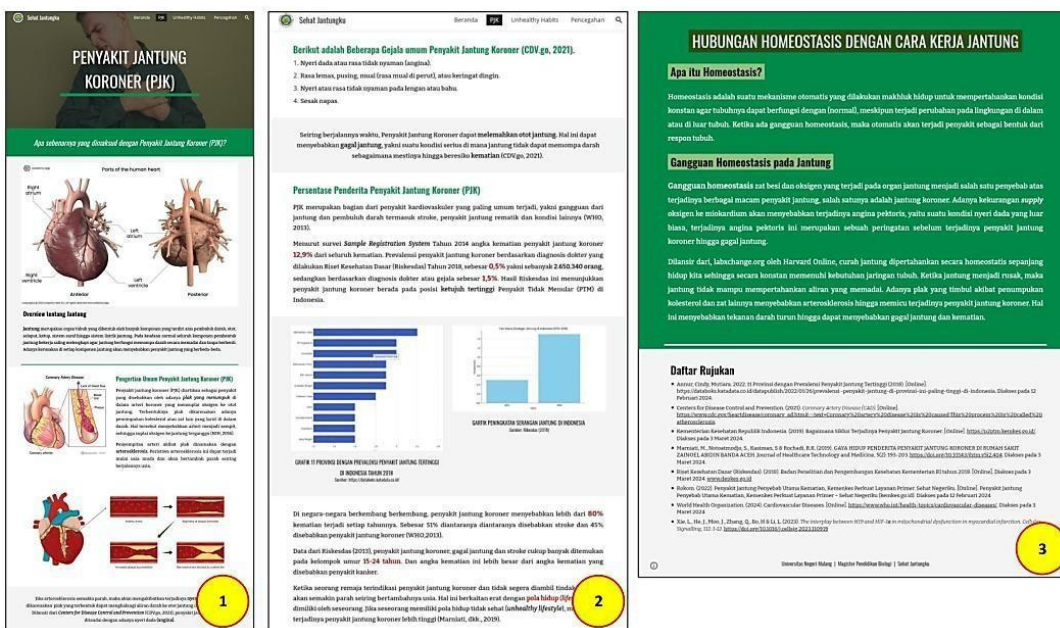


Figure 2. Navigation Menu 1 “Overview of Coronary Heart Disease”

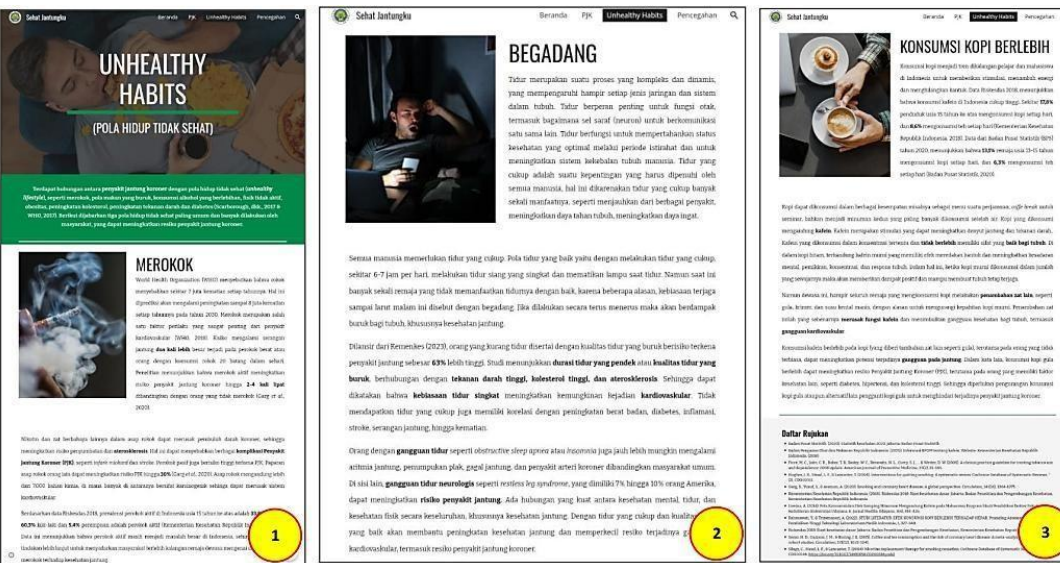


Figure 3. Navigation Menu 2 “Unhealthy Habits”

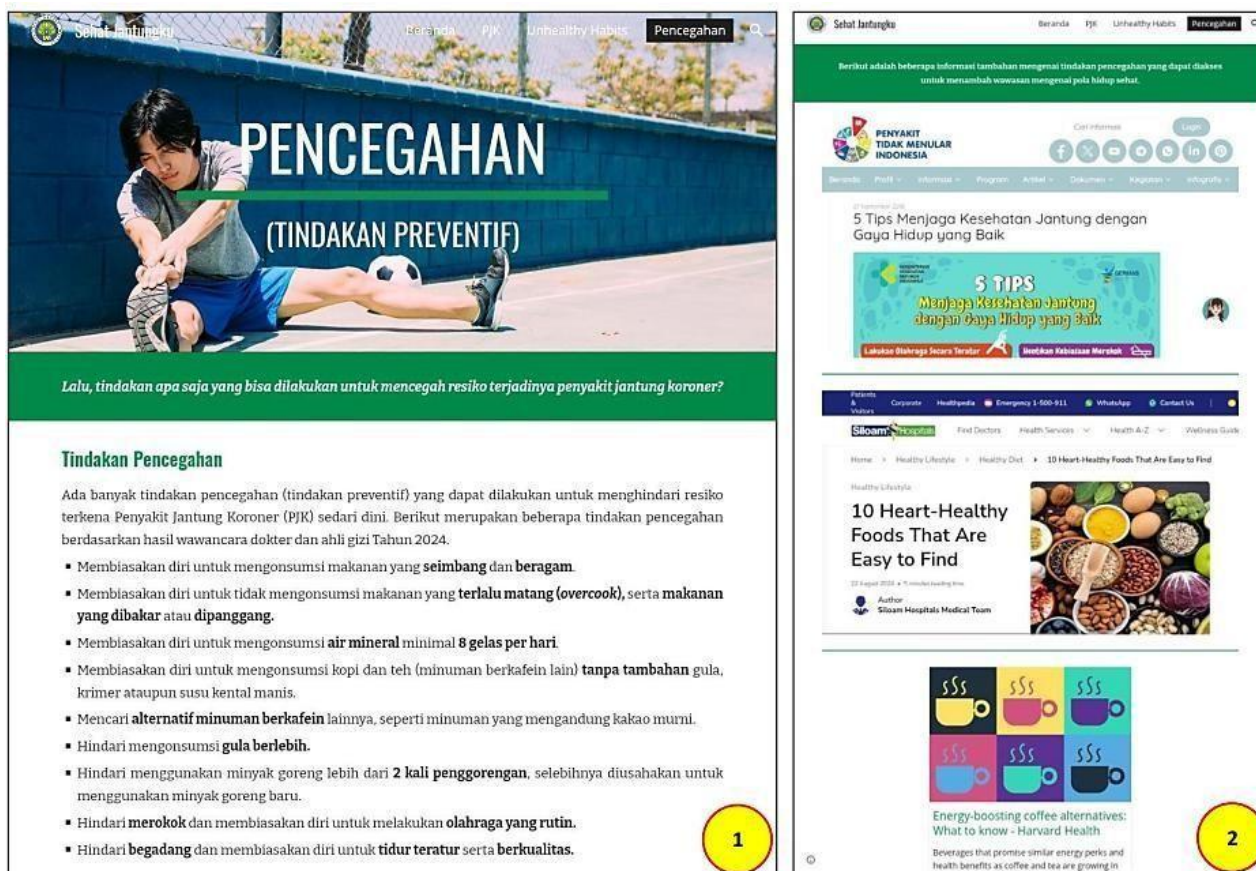


Figure 4. Navigation Menu 3 “Prevention of Coronary Heart Disease”

Discussion

This development research produced a Google Sites (G-Sites)–based educational media entitled “Sehat Jantungku” related to the prevention of Coronary Heart Disease (CHD). The development model adopted in this study was the 4-D model proposed by Sivasailam Thiagarajan, which consists of the stages of define, design, develop, and disseminate. In the first stage, namely the define stage, a preliminary needs analysis was conducted through literature studies from various sources.

The result of preliminary needs analysis indicated that one of the consequences of disrupted homeostasis in the human body is atherosclerosis, which is the primary cause of CHD (Yang et al., 2024; Zullo et al., 2022). Statistical data reported by the Institute for Health Metrics and Evaluation (IHME) (2021) showed that CHD, also commonly referred to as Ischemic Heart Disease (IHD), ranks as the leading cause of death worldwide, accounting for 13.25% of global mortality, and also ranks highest in Indonesia with a percentage of 10.69%. Furthermore, an official report from the World Heart Federation (WHF) stated that by 2019, the total number of deaths caused by CHD had reached 9.1 million cases globally, and this figure continues to increase annually (Cesare et al., 2023). Data from the Indonesian Basic Health Research (Riskesdas) in 2018 revealed that 2,650,340 individuals in Indonesia had been diagnosed with CHD, placing it as the seventh most prevalent Non-Communicable Disease (NCD) in Indonesia (Kemenkes, 2018).

In fact, not all adolescents and young adults aged 13–25 years possess adequate knowledge regarding CHD, its impacts and dangers to the body, as well as preventive measures that can be undertaken. Therefore, efforts to improve public knowledge regarding CHD are urgently needed (Van Deyk et al., 2010; Mackie et al., 2018; Uzark et al., 2015). Previous studies have demonstrated that, in this technologically advanced era, Google Sites–based health educational media are effective in educating the wider community (Kartikasari & Mustamu, 2022; Ulliana et al., 2024; Widayanti & Rahmawati, 2022).

Based on the preliminary needs analysis, the development of a Google Sites–based educational media entitled “Sehat Jantungku” as a campaign for the prevention of Coronary Heart Disease (CHD) was considered necessary. In the second stage, namely the design stage, the product was designed by determining the scope of the content, collecting learning materials, preparing interview instruments for several resource persons, developing the storyboard for the “Sehat Jantungku” Google Sites, and gathering supporting elements such as images and other visual components. The predetermined product content included: (1) definitions and general knowledge regarding CHD, (2) interview results with a medical doctor and a nutritionist as the main resource persons, (3) the relationship between CHD and body

homeostasis, (4) statistical data on CHD cases in Indonesia, (5) various unhealthy lifestyle patterns and their association with CHD, (6) strategies for CHD prevention, and (7) related articles concerning CHD.

In this development study, interviews were conducted with a general practitioner and a nutritionist, with the aim of providing readers, particularly adolescents and young adults, with comprehensive and reliable information regarding CHD. In addition, all materials presented in the media were based on valid sources and supported by reference lists to ensure that the information provided through the Google Sites platform did not lead to misconceptions among readers.

In the third stage, the development stage, the framework and materials that had been prepared and collected during the design stage were processed and integrated into the educational media in the form of Google Sites. The platform consisted of four navigation menus: (1) Home, (2) Overview of Coronary Heart Disease, (3) Unhealthy Habits, and (4) Prevention of Coronary Heart Disease. These four navigation menus encompassed the seven main content components that had been determined during the previous design stage. Screenshots of each navigation menu are presented in Figure 1, Figure 2, Figure 3, and Figure 4.

At this third stage, the development team also created official “Sehat Jantungku” promotional accounts on social media platforms. After the development process was completed, the product was validated by a physiology lecturer and a readability test was conducted with 16 master’s students in biology education as prospective users. These two processes aimed to identify any weaknesses of the product so that revisions could be carried out prior to dissemination. Based on the validation results, “Sehat Jantungku” was considered practical and feasible to be disseminated as an educational media for CHD.

The final stage (dissemination stage), involved distributing the “Sehat Jantungku” educational media online through promotional activities on social media platforms such as Instagram and TikTok. This dissemination strategy aimed to achieve broader engagement and effectively reach the primary target audience, namely adolescents and young adults. This is supported by data from the Asosiasi Penyelenggara Jasa Internet Indonesia (APJII) (2024), which reported that the largest proportion of internet users belongs to Generation Z, aged 12–27 years, with the primary purpose of internet use being social media access. The average duration of internet access ranges from 1–5 hours per day through smartphones, laptops, computers, and tablets. Therefore, disseminating the “Sehat Jantungku” Google Sites-based educational media through online social media platforms represents an effective strategy.

The development of the Google Sites-based “Sehat Jantungku” educational media offers several advantages, one of which is its practicality and flexibility, allowing users to access the media anytime and anywhere. This finding is consistent with previous studies indicating that Google Sites-based educational media provide time efficiency and do not depend on specific times or locations for access (Ela & Dermawan, 2023; Rofika et al., 2022). “Sehat Jantungku” also provides valid information based on summarized data and factual evidence, making it easier for the general public to understand CHD. Users are less likely to experience misconceptions because the platform is equipped with direct links to interview results with medical doctors and nutritionists (Figure 1). In addition, users can access reliable articles regarding CHD that are provided through the sidebar and reference lists (Figures 2, 3, and 4).

According to Djoko et al., (2024), educational processes conducted through Google Sites can be more structured, comprehensive, and interactive through integration with other Google products as well as the addition of visual elements such as images and animations. From a design perspective, “Sehat Jantungku” features a simple navigation menu while still maintaining aesthetic value, complemented by relevant images and illustrations that enhance user interest and reduce boredom. Previous studies have similarly demonstrated that the utilization of Google Sites as educational media allows developers greater flexibility in determining themes and designs, resulting in visually appealing platforms that effectively improve reading interest, learning motivation, and reduce user boredom when accessing information (Nugroho & Hendrastomo, 2021; Nurlatifah & Suprihatiningrum, 2023; Pratama et al., 2023; Sevtia et al., 2022).

Conclusion

In conclusion, this study successfully developed a Google Sites-based educational media entitled “Sehat Jantungku” as a campaign media for the prevention of Coronary Heart Disease (CHD) through the implementation of the 4-D development model proposed by Sivasailam Thiagarajan. The media was systematically developed through the stages of define, design, develop, and disseminate, supported by interviews with experts, namely a medical doctor and a nutritionist, as well as valid literature sources. The resulting platform was validated as highly feasible and practical for use as a health education medium without misinformation. Furthermore, the integration of Google Sites with social media platforms such as Instagram and TikTok enabled broader dissemination and engagement, particularly among adolescents and young adults. Therefore, “Sehat Jantungku” demonstrates the potential of technology-based educational media to effectively enhance public awareness and understanding regarding the prevention of CHD. This study also demonstrates that Google Sites can be utilized and further developed as an online educational medium not only for CHD but also for other disease-related cases.

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