

Design and Development of Google Sites-Based Interactive Learning Media for Wired and Wireless Network Technologies

Hanesa Putri Wulandari^{1*}, Asrul Huda¹

¹ Department of Electronics Engineering, Faculty of Engineering, Universitas Negeri Padang, Padang, **Indonesia**

*Corresponding Author Email: nesann09@gmail.com

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Abstract: The advancement of Information and Communication Technology (ICT) has significantly reshaped education, prompting the integration of technology-based learning media to improve instructional quality. Tools such as visual graphics, interactive texts, and educational videos enhance student comprehension and engagement. Google Sites, a free web-based platform, offers flexibility for delivering content across varied learning environments without requiring additional software. This study developed interactive learning media using Google Sites to support instruction in wired and wireless network technologies within vocational education. Employing the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), the research addressed the lack of interactive media and students' difficulties in grasping technical concepts. The resulting platform integrates texts, diagrams, video tutorials, and quizzes in a modular format suitable for both classroom and independent learning. Evaluation findings showed that 93% of students found the media easy to use, and 90% reported improved understanding. The study demonstrates a scalable approach to ICT-based learning and contributes to enhancing competency-based instruction in vocational contexts with limited infrastructure.

Keywords: Learning Media; Google Sites; Network Technology; Vocational Education; ADDIE; Interactive Learning.

1. Introduction

The rapid advancement of information and communication technology (ICT) has had a significant impact on various sectors of life, including the field of education [1]–[3]. In this digital era, the education sector is required to continuously innovate in order to improve the quality of the learning process and remain relevant to current demands [4]–[6]. Quality education is not solely determined by the availability of physical infrastructure and human resources, but is also heavily influenced by the use of appropriate and effective learning media [7]–[9]. Well-designed learning media can serve as a crucial tool in

delivering instructional content in a more engaging, interactive, and easily comprehensible manner for students [10].

In Vocational High Schools (SMK), particularly in the Computer and Network Engineering (TKJ) program, mastery of wired and wireless network technology is essential as a core competency that students must acquire [11], [12]. However, in practice, there are still numerous obstacles in delivering this material effectively, including limited time, insufficient practical facilities, and the lack of supportive learning media [13], [14]. Based on observations and interviews with teachers at SMK Negeri 5 Padang, it was found that students still face difficulties in understanding the concepts of wired and wireless networks. One of the contributing factors is the absence of interactive learning media that aligns with both the students' characteristics and the demands of the subject matter.

To address this issue, there is a need to develop learning media that not only present the material visually and systematically, but also leverage technology that is easily accessible to students. One practical solution is the use of Google Sites, a free platform by Google that enables users to create and manage websites effortlessly. Google Sites can serve as an interactive platform that integrates text, images, videos, and external links into a single, structured page. Furthermore, its accessibility via mobile devices and computers makes it a flexible learning tool that meets the needs of today's digital-native learners.

This study aims to develop an interactive learning media assisted by Google Sites for the topic of wired and wireless network technology at SMK Negeri 5 Padang. Using the Research and Development (R&D) approach with the ADDIE model, this media is designed to enhance students' understanding of the subject, improve access to learning resources, and foster students' interest and motivation. It is expected that the resulting product will serve as an effective alternative learning solution and can be widely applied in other vocational education contexts, especially those related to information technology and computer networking.

2. Material and methods

2.1 Type and Research Approach

This research is a development study (Research and Development/R&D) aimed at producing an interactive learning media product based on Google Sites for the subject of wired and wireless networks. This approach was chosen because it enables systematic product development and allows for testing the effectiveness and feasibility of the product within an educational context. The development model used is the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation.

The ADDIE model is used because it is procedural and systematic in constructing teaching materials, whether for face-to-face or online learning. Each stage has a specific purpose that is interconnected, starting from needs analysis to the final evaluation of the developed learning media.

2.2 Needs Analysis and Problem Identification

The first stage of the ADDIE model is the analysis phase. In this stage, information is gathered to analyze the needs and identify problems occurring in the learning environment, particularly in the Computer and Network Engineering (TKJ) department at SMK Negeri 5 Padang. Based on field observations and interviews with subject teachers, several obstacles that hinder the smoothness of the learning process were identified. One of the main obstacles is the limited time available to deliver practical network material comprehensively. In addition, the availability of practical equipment such as UTP cables, network devices, and computers is still very limited, making it difficult for all students to engage in optimal practice.

Furthermore, the learning media currently used remains conventional and lacks variation; it also does not accommodate technological developments or the learning characteristics of students, who tend to be visual and interactive learners. This has resulted in a low level of student understanding of wired and wireless network concepts, especially when the material is delivered only through lectures or text-based presentations without visual aids.

Based on these conditions, it can be concluded that there is a need for learning media that can facilitate students in a more visual, interactive, and flexible manner. Such media is also expected to reduce dependence on physical hardware in network practice learning, so that students can still understand the material well despite the limitations in facilities and infrastructure.

2.3 Design of the System and Learning Media

The next stage is the design of the learning media, which aims to outline the framework and structure of the system to be developed. The design process involves identifying the functional and non-functional requirements of the learning media system, as well as developing a model of user interaction with the system.

The media is designed based on the Google Sites platform due to its various advantages, such as ease of use, integration with other Google services, cross-device accessibility, and no need for additional installation.

During this stage, a Use Case Diagram is also created to map out the actors (users) and the functionalities of the system to be used by each type of user, namely teachers and students. This diagram illustrates the relationship between

users and the system, as well as the main features available, such as accessing materials, watching instructional videos, and working on practice questions.

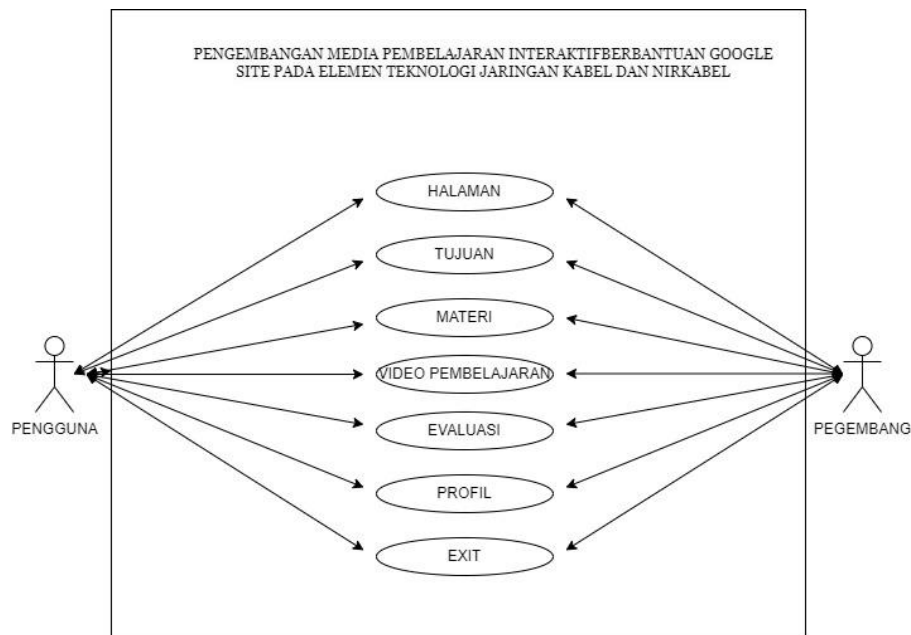


Figure 1. Use Case Diagram of Google Sites-Based Learning Media

2.4 Development of Learning Media

After the design phase is completed, the process continues to the development stage of the learning media. In this phase, the media is built concretely using the Google Sites platform as the main foundation. The development is carried out based on the needs analysis and system design that were prepared in the previous stages.

The learning content developed includes various key elements designed to support students' visual and practical learning styles. The core material is presented in the form of text that systematically and clearly explains the basic concepts of wired and wireless networks. To enhance understanding, the media is also equipped with supporting images such as diagrams, illustrations of hardware, and network connection flows.

In addition, instructional videos are included, featuring simulations of cable installation and network configuration, aimed at providing students with a practical overview. As a form of evaluation and practice, the media also offers interactive quizzes created through Google Forms and Quizizz, which are directly integrated into the site's pages.

All of these elements are packaged in an integrated platform, with the goal of promoting student independence in learning and providing a more engaging and meaningful learning experience, both inside and outside the classroom.

2.5 Implementation and Evaluation

The developed learning media was then implemented in the teaching and learning activities of Grade X students in the Computer and Network Engineering (TKJ) department at SMK Negeri 5 Padang. The implementation process was carried out with direct assistance from the subject teacher and accompanied by observations of student engagement and responses during the use of the media. The goal of this implementation was to assess how effectively the learning media could be applied in the classroom and to what extent it contributed to students' understanding of wired and wireless network materials.

Following the implementation process, the next stage was the evaluation of the learning media. This evaluation aimed to assess the quality, effectiveness, and feasibility of the developed media. The assessment was conducted using questionnaires distributed to both teachers and students. The questionnaire included several key indicators, such as ease of use, clarity of the presented material, students' interest in the design and content of the media, and the effectiveness of learning time achieved. The results of this evaluation serve as a critical foundation for refining and improving the learning media so that it can be used sustainably and provide maximum benefits in supporting the learning process at school.

3. Results and discussion

3.1 General Description of the Developed Learning Media

The result of this research is an interactive learning media product based on Google Sites, designed to support the learning process of wired and wireless network materials for Grade X students of the Computer and Network Engineering (TKJ) department at SMK Negeri 5 Padang. This learning media was developed using the ADDIE model, which includes the stages of Analysis, Design, Development, Implementation, and Evaluation.

The media was developed as a solution to challenges encountered in the field, such as limited instructional time, lack of practical equipment, and the absence of learning media suited to the predominantly visual and interactive learning characteristics of students. Therefore, Google Sites was chosen as the main platform due to its flexibility, accessibility across various devices, and support for multimedia integration.

3.2 Display and Features of the Learning Media

This learning media has a structured interface and features that support independent and guided learning activities. Below is a description of each main section of the developed media:

3.2.1 Splash Screen Display

The splash screen is the initial page that appears when users first open the learning media. This page serves as a visual introduction to the media's identity and gives a professional and appealing first impression. It displays the application logo and the name of the learning media, which reflects the main topic: Interactive Learning Media Assisted by Google Sites on Wired and Wireless Network Technology Elements.



Figure 2. Splash Screen Display

3.2.2 Main Menu Display

After the splash screen, users are directed to the main menu page. This page acts as the central navigation hub connecting all key features of the learning media. Several main menu buttons are available, including: Learning Objectives, Materials, Learning Videos, Assignments, Profile, and Exit. The interface design follows the principles of easy navigation and high readability to help students access information as needed.



Figure 3. Main Menu Display

3.2.3 Learning Objectives Menu Display

This menu contains a list of learning objectives to be achieved. These objectives are based on the core competencies outlined in the curriculum, allowing students to understand the direction and expected outcomes of the learning process. The objectives are presented in communicative language and include a navigation button to return to the main menu.



Figure 4. Learning Objectives Menu Display

3.2.4 Learning Materials Menu Display

The learning materials are organized systematically and divided into six subtopics related to wired and wireless networking. Each subtopic is presented through explanatory text enriched with images, diagrams, and illustrations of relevant devices. The content is structured based on students' comprehension levels, ensuring that the explanations remain concise yet easy to understand. The six subtopics include: the definition of wired and wireless network installation; testing of wired and wireless networks; maintenance and repair of wired and wireless networks; wireless network standards; types of indoor and outdoor wireless network technologies; and Voice over IP (VoIP) service technology.



Figure 5. Subtopic Display

3.2.5 Learning Videos Menu Display

This menu provides a collection of instructional videos that include visual demonstrations such as how to install network cables, test connectivity, and

simulate network configurations. These videos are intended to provide a practice-based learning experience that students can repeat independently.



Figure 6. Learning Videos Display

3.2.6 Assignments Menu Display

In the assignments menu, students are given exercises to serve as formative evaluation of the material studied. The tasks are presented as interactive quizzes integrated through Google Forms and Quizizz. Additionally, students can upload their assignment results directly through the provided upload feature. Teachers can also monitor which students have submitted their assignments via a task list view.



Figure 7. Display of Quizzes, Upload Feature, and Assignment List

3.2.7 Profile Menu Display

This menu contains information about the development team behind the learning media, including the name of the researcher, supervising teacher, and the developing institution. The inclusion of the profile menu is intended to provide transparency and recognition to the individuals involved in the media development.



Figure 8. Profile Menu Display

3.3 Implementation and User Feedback

After the development of the interactive learning media based on Google Sites was completed, the next stage was its implementation with Grade X students of the Computer and Network Engineering (TKJ) department at SMK Negeri 5 Padang. The implementation was carried out in a real classroom setting, involving the subject teacher as the main facilitator and direct observation of student engagement during the learning process.

Field observations indicated that the use of this learning media had a positive impact on increasing student participation and motivation. Overall, students showed higher enthusiasm compared to conventional learning methods. They also appeared more focused and actively engaged while exploring the materials, watching simulation videos, and completing the practice questions provided within the platform.

To measure students' and teachers' perceptions of the developed learning media, a questionnaire was distributed to 30 student respondents and one subject teacher. The questionnaire included several evaluation indicators, such as ease of use, improvement in material comprehension, learning motivation, and learning effectiveness. The following is a summary of the questionnaire results presented in table form:

Table 1. Student Feedback Questionnaire Results on the Learning Media

No	Assessment Aspect	Percentage
1	Media is easy to use	93%
2	Material is easy to understand	90%
3	Increases learning motivation	87%
4	Media has an attractive and interactive design	92%
5	Flexible access to materials (anytime & anywhere)	95%

Based on the data, it can be concluded that the majority of students responded positively to the learning media. A total of 93% of students stated that the media was very easy to use without the need for additional technical training. Most students (90%) also felt that their understanding of the material improved thanks to the visual support provided through images and videos. In addition, 87% of students reported that the media increased their motivation to learn compared to lecture-based methods or relying solely on textbooks. This is further supported by the finding that 95% of students felt they benefited from the media's flexible accessibility via mobile devices or computers [15]–[17].

The subject teacher also gave highly positive feedback on the learning media. The teacher stated that it was very helpful in delivering complex learning materials such as network installation, connection testing, and network configuration. Moreover, the teacher acknowledged that the use of this media helped save classroom time, as students had already studied part of the material independently outside of class hours. Overall, the results of the implementation and evaluation show that this Google Sites-based interactive learning media is highly feasible for use as an innovative and effective alternative learning strategy in the context of network technology education in vocational schools.

3.4 Discussion

The results of the design and implementation of Google Sites-based interactive learning media indicate a significant improvement in the effectiveness of teaching and learning wired and wireless network concepts. The developed media integrates instructional texts, illustrative diagrams, simulation videos, and interactive quizzes into a structured and easily accessible web-based platform. This integration not only improves the efficiency of instructional delivery but also enhances students' understanding of technical content through multimodal learning resources.

Key advantages of the media include its intuitive interface, cross-device accessibility, and flexibility for both synchronous and asynchronous learning contexts. These features address several challenges commonly encountered in vocational network instruction, such as limited laboratory infrastructure, time constraints for hands-on practice, and the lack of engaging, student-centered instructional materials. According to multimedia learning theory, the simultaneous use of text, images, and animation can significantly enhance retention and comprehension [18]–[21]. This aligns with the findings of the current study, where 90% of learners reported improved conceptual understanding, and 93% considered the media easy to use, based on structured evaluation instruments.

Existing instructional materials in the domain of computer networks have largely relied on conventional media such as printed modules, offline presentations, or basic simulation tools. While previous developments have

shown some efficacy, many lacked features such as integrated assessments, mobile compatibility, and real-time interactivity [22]–[26]. Moreover, most were teacher-centered and did not adequately support self-directed learning or accommodate diverse learning preferences.

This study addresses those limitations by presenting a cloud-based, modular, and interactive learning platform developed using Google Sites. The media enables real-time access to content without requiring software installation, supports multi-device use, and allows for autonomous learning. Unlike complex authoring environments, Google Sites offers an intuitive interface that enables educators to independently create, update, and distribute content, thereby contributing to sustainability and scalability in digital instructional design [27], [28].

Furthermore, the platform aligns with contemporary curriculum frameworks that emphasize competency-based and student-centered learning approaches. By promoting exploratory, self-paced engagement, the media fosters learner autonomy and digital literacy – competencies that are essential in 21st-century vocational education.

In practical application, the platform simplifies complex technical topics by providing visual explanations and guided simulations of activities such as cable installation, device configuration, and wireless protocol identification. These features reduce cognitive load and render abstract content more accessible and relatable. Additionally, by extending learning beyond formal instructional hours, the platform bridges the gap between theory and practice, enhancing flexibility and deepening skill acquisition.

4. Conclusion

This study successfully designed, developed, and implemented Google Sites-based interactive learning media to support instruction in wired and wireless network technologies within vocational education settings. Utilizing the ADDIE development model, the platform integrates textual explanations, visual diagrams, instructional videos, and interactive quizzes into a cohesive and accessible digital environment. The findings demonstrate that the media improves student engagement and comprehension by addressing common instructional challenges, including limited practice time, insufficient physical resources, and the absence of interactive content. Its design aligns with student-centered pedagogical principles and supports both classroom and independent learning modalities.

The use of Google Sites as a low-threshold, cloud-based platform represents a practical and scalable innovation in digital learning media. It offers ease of use, cross-device accessibility, and does not require advanced infrastructure or technical expertise, making it suitable for under-resourced vocational settings.

These advantages support the cognitive principles of multimedia learning theory, particularly in enhancing dual-channel information processing and knowledge retention [29]–[31]. The study contributes to the ongoing discourse on digital transformation in vocational and technical education.

Limitations of the study include its implementation within a single institution and the reliance on qualitative and perception-based outcomes. These constraints limit the generalizability of the findings.

Future research should consider broader samples across different vocational domains and employ experimental or quasi-experimental designs to rigorously assess learning effectiveness. Moreover, integrating the media with Learning Management Systems (LMS), augmented reality (AR), or virtual labs may further enhance learner autonomy, personalized feedback, and the development of practical skills in simulated environments.

In conclusion, the media developed in this study provides a viable, accessible, and pedagogically sound approach for improving instructional delivery in vocational education. Continued exploration across diverse contexts and the incorporation of emerging educational technologies are recommended to extend its impact and applicability.

Author's declaration

Author contribution

Hanesa Putri Wulandari was responsible for conceptualizing the study, conducting the needs analysis, designing the learning media, developing the Google Sites platform, collecting user feedback, and drafting the manuscript. **Asrul Huda** contributed to research supervision, provided methodological guidance throughout the ADDIE development process, supported the analysis and interpretation of results, and reviewed and edited the final manuscript for intellectual content. Both authors have read and approved the final version of the manuscript.

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Competing interest

The authors declare no competing interest.

Ethical clearance

This study was conducted in accordance with ethical research standards. Prior to data collection, informed consent was obtained from all participants, including teachers and students, involved in the implementation and evaluation of the learning media. Participation was entirely voluntary, and all personal data were anonymized to ensure confidentiality and privacy. The research protocol was reviewed and approved by the Ethics Committee of the Department of Electronics Engineering, Faculty of Engineering, Universitas Negeri Padang. All procedures complied with the ethical principles outlined in the Declaration of Helsinki for educational research involving human subjects.

AI statement

This article is the author's original work, written from original research and no sections or figures are generated by AI. English is checked using Grammarly and has been verified by the authors.

Publisher's and Journal's note

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