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Development of Interactive Video Tutorials for LAN Network Simulation in Grade XI TJKT at SMKN 1 Bonjol

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ABSTRACT

Conventional guides and linear, one-way video tutorials used in Local Area Network (LAN) simulation practical sessions tend to make students passive and create difficulties in understanding technical procedures. This study aims to develop interactive video tutorial media as a valid and practical digital practical guide to improve the quality of self-directed learning. The research employed a Research and Development (R&D) approach using the Multimedia Development Life Cycle (MDLC) model, consisting of six stages: concept, design, material collecting, assembly, testing, and distribution. The media was developed by integrating CapCut, Cisco Packet Tracer, Canva, and Lumi H5P to provide interactive features such as pop-up quizzes and auto-pause. Data were collected through questionnaires and analyzed using Aiken's V index for validity and percentage formulas for practicality. The results showed that the developed media achieved a very high level of validity, with an average media validity score of 0.926 and material validity score of 0.8194. The practicality level reached 91.94% based on teacher responses and 92.37% based on student responses, both categorized as very practical. These findings highlight the importance of H5P-based interactive media in providing immediate feedback and structured practical guidance.

1. Introduction

In the Computer Network and Telecommunications Engineering (TJKT) program, mastery of network infrastructure is one of the core competencies that vocational high school (SMK) students are expected to acquire. The implementation of the Merdeka Curriculum requires vocational learning to adopt a student-centered learning approach by integrating intensive practical activities to provide students with concrete learning experiences [1], [2]. In Grade XI (Phase F), Local Area Network (LAN) simulation is an essential topic that covers an understanding of network topologies, IP addressing schemes, device configuration, and connectivity testing. The complexity of the technical procedures involved requires supplementary learning media that can guide students in a structured and independent manner [3], [4].

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However, this ideal learning condition has not been fully achieved in the practical sessions of Grade XI TJKT at SMKN 1 Bonjol. Based on initial observations and interviews with the subject teacher, several critical issues were identified in the LAN simulation practical learning process. The main issue is the limited availability of practical guides, which are still dominated by conventional printed jobsheets and PDF-based text documents. These static, text-based guides make it difficult for students to visualize the dynamic and procedural flow of network configuration. Meanwhile, supplementary learning through linear video tutorials from external platforms such as YouTube has not provided an optimal solution because it relies on one-way communication and passive viewing [5], [6]. As a result, students tend to watch the videos without active cognitive engagement, lose focus quickly, and often miss crucial steps in the configuration process [7], [8].

To address these challenges, an innovative digital practical guidance tool is needed—one that is adaptive and capable of actively engaging students. The development of interactive video tutorial media offers a potential solution through the integration of the Lumi (H5P) platform [9], [10]. The media incorporates features such as auto-pause, pop-up questions or quizzes embedded between instructional segments, and immediate feedback [11], [12]. These features guide students progressively from one practical stage to the next while ensuring that their understanding of the concepts is assessed before they proceed to subsequent instructions [13], [14]. A review of previous relevant studies further reinforces the need for this innovation. Sanjaya (2024) emphasized that applying the Multimedia Development Life Cycle (MDLC) model in the development of interactive videos can improve the efficiency of practical learning and significantly promote students' independent learning [15]. Nevertheless, previous studies have generally focused on interactive videos in a broader context or on theoretical content delivery. They have not specifically integrated H5P-based, real-time formative assessment features as a practical guidance tool for LAN simulation under the Merdeka Curriculum in vocational high schools. Based on the identified problems, learning challenges, and review of previous studies, this research aims to develop Interactive Video Tutorial Media for LAN Network Simulation for Grade XI TJKT at SMKN 1 Bonjol and to analyze its validity and practicality to determine its suitability as an effective digital practical guide.

2. Method

Figure 1 illustrates the research method employed by the authors to achieve the objectives established at the outset. The system development process consists of six stages: Concept, Design, Material Collecting, Assembly, Testing, and Distribution.

2.1. Concept

The first stage in the development of this media is the *Concept* stage, which aims to establish the overall foundation and direction of the project. At this stage, an analysis is conducted to determine the purpose of developing the media, namely to assist Grade XI TJKT students at SMKN 1 Bonjol in understanding LAN network simulation materials, which can be difficult to grasp when taught solely through theoretical explanations. In addition to defining the objectives, this stage also identifies user needs, particularly students who require practical visual guidance in the form of an interactive video tutorial delivered through a web link that can be accessed flexibly using mobile devices (*mobile-friendly*).

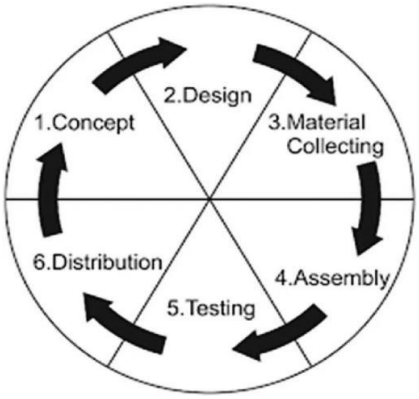


Fig. 1 - Agile methodology

2.2 Design

After the basic concept has been established, the next stage is the Design stage, which focuses on developing the visual architecture and interaction flow of the media. The main activities at this stage include creating an interactive flowchart to map the media's branching logic, such as determining when evaluation quizzes and other interactive elements will appear. Subsequently, a storyboard is developed to describe the details of the visual presentation minute by minute, instructional narration text, and the forms of contextual interaction to be produced in the subsequent stage. The flowchart illustrates the workflow of the developed interactive video tutorial media (Figure 2 - Figure 3).

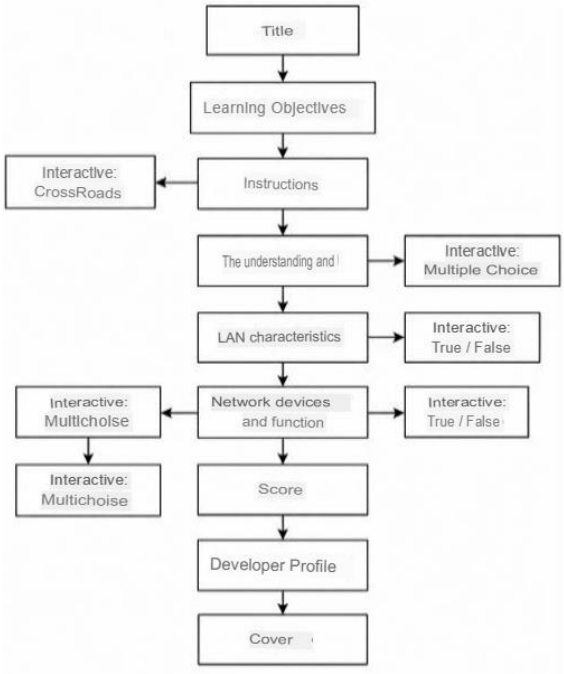


Fig. 2 - Basic LAN Concepts Video Flowchart

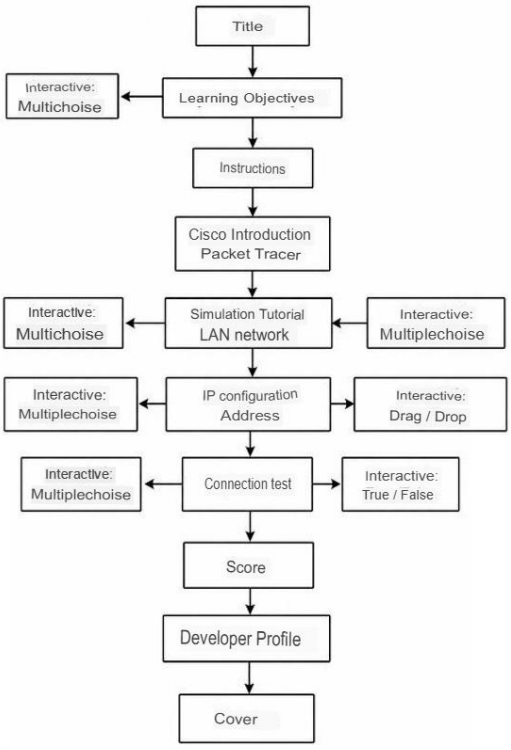


Fig. 3 – LAN Network Design Video Flowchart

2.3 *Material Collecting*

The material collection stage is carried out to gather all digital assets or "raw materials" required in accordance with the storyboard guidelines that have been developed. At this stage, the collection process includes recording the step-by-step network configuration using Cisco Packet Tracer, preparing the instructional text for LAN materials, and selecting copyright-free audio.

2.4 Development

The assembly stage is the core production process in which all previously collected materials and digital assets are combined into a complete learning media product. This process begins by cutting, editing, and synchronizing the Cisco simulation recordings with voice-over narration or instructional text using CapCut. Once the video has been finalized, it is integrated into the Lumi H5P platform to incorporate interactive elements, such as multiple-choice quizzes embedded within the video, drag-and-drop activities for network components, fill-in-the-blank exercises, and a link button directing users to an external web-based simulator at the end of the video. This process results in the initial media prototype.

2.5 *Testing*

The testing stage is conducted after the media prototype has been completed to ensure the academic feasibility and technical functionality of the product before it is distributed. The testing process consists of two main stages. First, validation is conducted by a subject-matter expert, such as a lecturer or teacher specializing in TJKT, to assess the accuracy and relevance of the LAN simulation content. Second, media validation is conducted by a media expert to evaluate the visual and audio quality, as well as the functionality of the H5P interactive features. After the media has been declared valid by the experts, a small-group trial is conducted involving Grade XI TJKT students at SMKN 1 Bonjol. A questionnaire is used during this trial to measure the practicality of the media and its ease of access directly through students' mobile phones.

2.6 *Distribution*

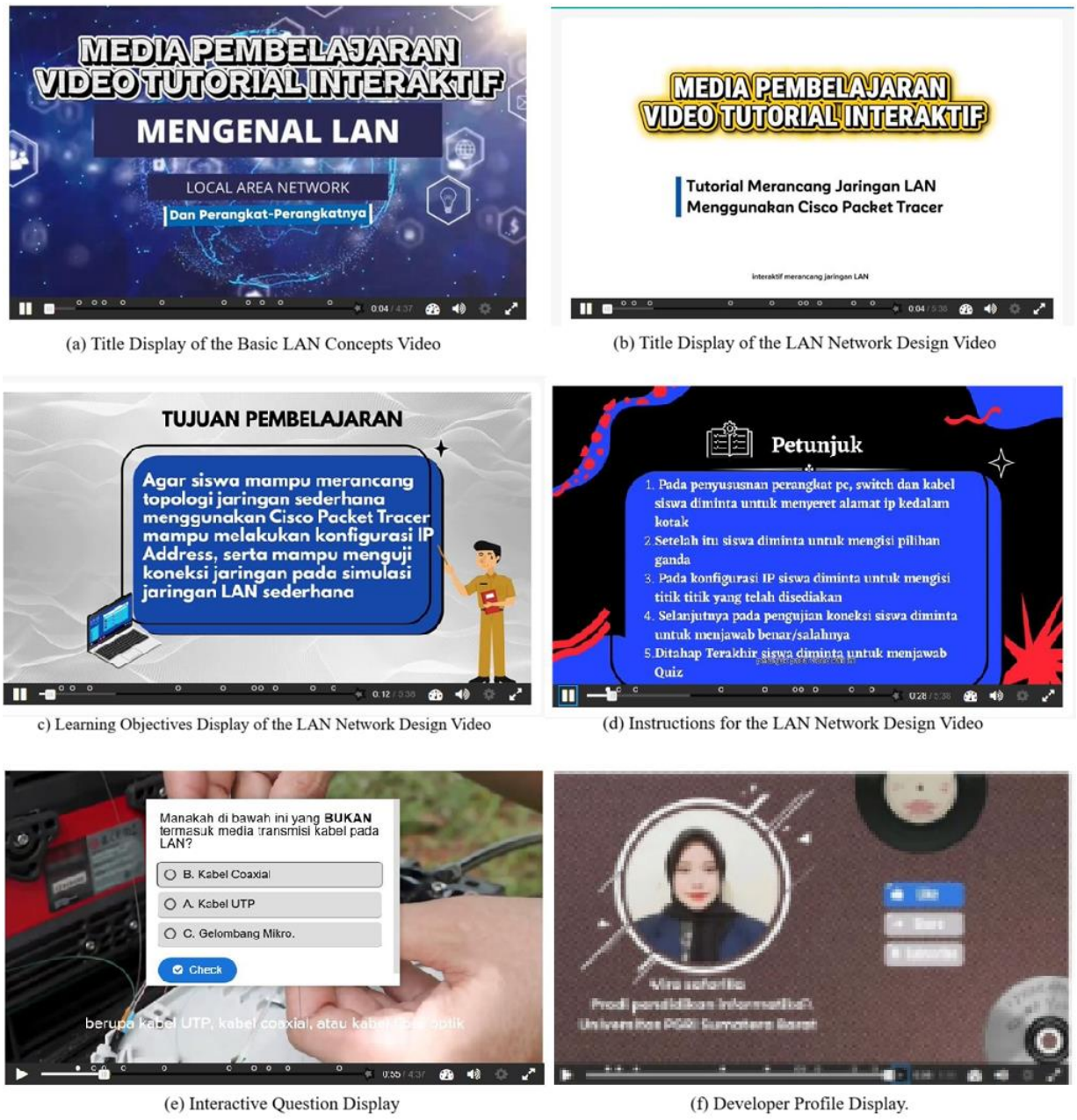
The final stage of the MDLC model is distribution, in which the interactive video tutorial that has been validated and demonstrated to be practical is disseminated for use in actual learning activities. At this stage, the final product is packaged as a web-based H5P link or directly integrated into a Learning Management System (LMS) or Google Classroom. Alternatively, the link can be distributed through the class group. The link is then shared with the subject teacher and all Grade XI TJKT students, enabling them to conduct independent simulations through their mobile phone browsers without having to download any additional applications.

3. Result and Discussion

The development of this research resulted in a learning media product in the form of an Interactive Tutorial Video on LAN Network Simulation material for Grade XI TJKT students at SMKN 1 Bonjol. The media was developed using the Multimedia Development Life Cycle (MDLC) model by integrating CapCut, Cisco Packet Tracer, and Lumi H5P applications. The media is presented through a web-link-based visual interface that can be accessed flexibly via mobile devices. The media interface consists of a title section, learning objectives, usage instructions, interactive pop-up quizzes embedded throughout the video, and a developer profile page. In terms of interactivity, the media is equipped with an auto-pause mechanism and formative quizzes, including multiple-choice, true/false, and drag-and-drop questions, at each minute of the video. This mechanism requires users to answer the evaluation questions directly and receive feedback before they can continue watching the video to the next stage.

3.1. The interface of interactive tutorial video

Figure 4 shows the interface of interactive tutorial video media: (a) Title Display of the Basic LAN Concepts Video, (b) Title Display of the LAN Network Design Video, (c) Learning Objectives Display of the LAN Network Design Video, (d) Instructions for the LAN Network Design Video, (e) Interactive Question Display, and (f) Developer Profile Display.



(a) Title Display of the Basic LAN Concepts Video

(b) Title Display of the LAN Network Design Video

c) Learning Objectives Display of the LAN Network Design Video

(d) Instructions for the LAN Network Design Video

(e) Interactive Question Display

(f) Developer Profile Display.

Fig. 4 - The interface of interactive tutorial video media

3.2. Evaluaiton results

The results of the three testing scenarios that were conducted are presented below.

A. Media Validity Evaluation Results

The research data were collected through validation and practicality questionnaires using a 1–5 Likert scale. The validity data were analyzed using Aiken's V Index (Table 1).

Table 1 - Media Validity Evaluation Results

No.	Validator	Validation Result	Category
1	Validator 1	0.875	Highly Valid
2	Validator 2	0.937	Highly Valid
3	Validator 3	0.958	Highly Valid
Average		0.926	Highly Valid

Based on the data processing results and the validation percentage of the interactive video tutorial media assessed by media experts, Validator 1 obtained a validation score of 0.875, categorized as "Highly Valid"; Validator 2 obtained a validation score of 0.937, categorized as "Highly Valid"; and Validator 3 obtained a validation score of 0.958, also categorized as "Highly

Valid." Based on the media validation assessment, the overall evaluation by all validators resulted in an average score of 0.926, categorized as "Highly Valid," indicating that the media is suitable for use as a learning medium.

B. Material Validity Evaluation Results

Table 2 - Material Validity Evaluation Results

No.	Validator	Validation Result	Category
1	Validator 1	0.8333	Highly Valid
2	Validator 2	0.7708	Valid
3	Validator 3	0.8541	Highly Valid
Average		0.8192	Highly Valid

Based on the data processing results (Table 2) and the validation percentage of the interactive video tutorial media assessed by material experts, Validator 1 obtained a validation score of 0.8333, categorized as "Highly Valid"; Validator 2 obtained a validation score of 0.7708, categorized as "Valid"; and Validator 3 obtained a validation score of 0.8541, categorized as "Highly Valid." Based on the material validation assessment, the overall evaluation by all validators resulted in an average score of 0.8192, categorized as "Highly Valid," indicating that the interactive video tutorial media is suitable for use as a learning medium.

C. Practicality Evaluation Results

Table 3 - Practicality Evaluation Results (1)

No.	Assessment Aspect	(%)	Category
1	Ease of Use	96	Highly Practical
2	Learning Efficiency	94.4	Highly Practical
3	Content and Presentation Quality	88	Highly Practical
4	Appearance and Interactivity	88	Highly Practical
5	Usefulness	93.3	Highly Practical
Average		91.94	Highly Practical

Based on the data processing results presented in the Table 3, the practicality level of the interactive video tutorial learning media, as assessed by the teacher, obtained an average score of 91.94%, categorized as "Highly Practical." Therefore, the interactive video tutorial media is considered feasible for use as a learning medium.

Table 4 - Practicality Evaluation Results (2)

No.	Assessment Aspect	(%)	Category
1	Media Appearance	92.67	Highly Practical
2	Ease of Use	91.73	Highly Practical
3	Material Understanding	92.9	Highly Practical
4	Interactivity and Motivation	91	Highly Practical
5	Usefulness	93.6	Highly Practical
Average		92.37	Highly Practical

Based on the data processing results presented in the Table 4, the practicality level of the interactive video tutorial media, as assessed by Grade XI TJKT students at SMKN 1 Bonjol, obtained an average score of 92.37%, categorized as "Highly Practical." Therefore, the interactive video tutorial media is considered feasible for use as a learning medium.

4. Conclusion

This study successfully developed an Interactive Video Tutorial Media for the LAN Network Simulation material for Grade XI TJKT students at SMKN 1 Bonjol through the six stages of the Multimedia Development Life Cycle (MDLC) model: Concept, Design, Material Collecting, Assembly, Testing, and Distribution, by integrating CapCut, Cisco Packet Tracer, and Lumi H5P. The interactive video tutorial media was proven to be Highly Valid, with an average Aiken's V index of 0.926 from media experts and 0.8194 from subject-matter experts. The media was also proven to be Highly Practical to use, with a practicality percentage of 91.94% based on teacher responses and 92.37% based on student responses. For future research, it is recommended that the development process be continued by conducting effectiveness testing.

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