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Development of Tutorial Video Based Learning Media for Network Service Technology Practicum Materials in Vocational High Schools

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A B S T R A C T

This study aimed to develop and evaluate video tutorial learning media for the Network Services Technology Practicum in Vocational High Schools using the HALDI development model. The research employed a Research and Development (R&D) approach, consisting of heuristic analysis, architectural design, instructional development, development testing, and implementation and dissemination stages. The feasibility of the developed media was assessed by an instrument expert, a media expert, and subject matter experts who are vocational high school teachers. The evaluation results showed feasibility percentages of 100% from the instrument expert, 100% from the media expert, and 96% from the subject matter experts, indicating a very feasible category. Practicality and effectiveness were tested through individual, small group, large group, and field trials. The individual trial showed 83% practicality and 85% effectiveness, while the small group trial achieved 90% practicality and 89% effectiveness. The large group trial resulted in 85% practicality and 88% effectiveness. Teacher responses indicated 94% practicality and 96% effectiveness. Field testing at SMK Negeri 6 Takalar and SMK Negeri 2 Makassar confirmed that the media is very practical and effective.

1. Introduction

Education is widely recognized as a fundamental pillar in shaping the quality of human resources and ensuring sustainable national development. Through education, individuals acquire essential knowledge, skills, and values that enable them to adapt to social change and technological advancement. In the context of globalization, education plays a strategic role in preparing future generations to face increasingly complex global challenges (Tilaar, 2018). Learning is not merely a process of transferring knowledge but also a medium for fostering character development, constructive behavior, and critical awareness among learners (Sanjaya, 2009). Consequently, the quality of education is often viewed as a key

determinant of a nation's success in achieving long-term economic, social, and technological progress (Hamalik, 2020).

Vocational education, in particular, has a distinctive role in preparing learners with job-ready competencies aligned with industry needs. Vocational High Schools are designed to equip students with practical skills, professional attitudes, and applied knowledge that are directly relevant to the workplace. In this context, learning processes must emphasize not only conceptual understanding but also procedural and technical skill mastery. Effective vocational learning requires instructional strategies and media that are capable of bridging theoretical concepts with real-world applications, especially in skill-oriented subjects (Sudjana, 2017).

One of the core subjects in vocational computer and network engineering programs is Network Service Technology. This subject focuses on developing students' competencies in designing, configuring, managing, and maintaining computer network services. Computer networks serve as critical infrastructure supporting various sectors, including industry, education, and global communication. Therefore, mastery of network service technology is essential for vocational students to remain competitive in the labor market. However, practicum-based learning in this subject often presents challenges, particularly when instructional media are limited to textbooks, static presentations, or basic simulations that fail to visualize complex configuration procedures effectively (Mangesa, 2018).

Along with rapid advancements in digital technology, the educational sector is increasingly required to integrate technology-based learning media to enhance instructional effectiveness and relevance. Digital learning media enable the transformation of conventional learning into more interactive, flexible, and learner-centered environments (Munir, 2017). The use of technology in education also supports the development of essential twenty-first-century skills, such as digital literacy, collaboration, problem-solving, and independent learning, which are critical in the era of the fourth industrial revolution (Sudjana, 2017).

Among various digital learning media, video tutorials have emerged as an effective instructional tool, particularly in practicum-based and skill-oriented learning contexts. Video tutorials present learning content in a visual, sequential, and systematic manner, allowing students to observe procedures directly, understand operational steps, and repeat learning activities according to their individual needs. According to (Mayer, 2001), multimedia learning that combines visual and verbal elements can significantly enhance learners' understanding and retention of complex information. Furthermore, video-based learning provides flexibility in terms of time and place, enabling students to engage in self-paced and independent learning (Rusman, 2019).

Several previous studies have highlighted the effectiveness of video-based and digital learning media in vocational education (Mangesa & Mappeasse, 2017). reported that the integration of the Kelase e-learning platform enriched instructional methods and significantly improved learning quality and student achievement in vocational schools. Another study by (Mangesa, 2018), demonstrated that a flipped

classroom model supported by video and audio media effectively enhanced students' cognitive development and learning attitudes. Similarly (Mustapa & Rahmah, 2019). Found that multimedia-based digital instructional materials were more effective than conventional teaching methods in improving students' academic performance in vocational settings.

However, although previous studies have confirmed the positive impact of video-based learning media, many vocational learning environments still lack systematically developed video tutorials that are specifically designed to support practicum activities in Network Service Technology. Existing learning videos are often used as supplementary materials rather than as integrated instructional media aligned with curriculum objectives and competency standards. Moreover, many video resources available online are not contextually adapted to vocational curricula, learning outcomes, or students' competency levels, limiting their effectiveness in practicum-based learning (Tilaar, 2018).

Observations conducted at State Vocational School 6 Takalar as the primary research site indicate that learning media for the Network Service Technology practicum are still dominated by textbooks, presentation slides, and simple simulations. These media provide limited interactivity and do not adequately visualize step-by-step network configuration procedures. As a result, students often experience difficulties in understanding procedural concepts and performing practicum activities independently.In contrast, observations at State Vocational School 2 Makassar as the trial site revealed that students demonstrated better comprehension and practicum performance when procedures were presented visually and systematically through video tutorial media. These findings indicate a clear gap between existing instructional practices and the learning media required to support effective and skill-oriented practicum learning.

From a theoretical perspective, instructional media development should be conducted systematically through a research and development approach to ensure feasibility, practicality, and effectiveness (Haryoko & Jaya, 2017). Emphasized that well-designed instructional media developed through structured stages—needs analysis, design, development, implementation, and evaluation—are more likely to address learning challenges in vocational education. Nevertheless, research focusing on the development of video tutorial learning media specifically for Network Service Technology practicum in vocational schools remains limited.

Based on the reviewed literature and field observations, there is a clear need to develop structured, curriculum-aligned video tutorial learning media that support practicum-based learning in Network Service Technology. Such media are expected to bridge the gap between theory and practice, enhance students' learning motivation, promote independent learning, and strengthen technical competencies relevant to industry demands. Therefore, the objective of this study is to develop and evaluate video tutorial–based learning media for the Network Service Technology practicum in Vocational High Schools, using a systematic development model to ensure the media's feasibility, practicality, and effectiveness in supporting vocational learning processes.

2. Methodology

Research instruments are tools used by researchers to collect data in a systematic, accurate, and efficient manner in order to obtain valid research results (Arikunto, 2013). In this study, the primary research instrument was a questionnaire developed using a five-point Likert scale. The scale ranged from 1, indicating strongly disagree, to 5, indicating strongly agree (Sugiyono, 2015). The questionnaire was designed to measure key aspects of the developed tutorial video learning media, including content quality, technical quality, ease of use, and instructional effectiveness. The instruments were validated and administered to material experts and media experts to assess the feasibility of the media. User responses were obtained from one subject teacher at the main research site, as well as from students, to evaluate the practicality and effectiveness of the tutorial video media in real learning conditions. This instrument design ensured that the data collected reflected both expert judgment and actual user experience.

Development Model

Vocational High Schools (SMK). The developed product was not only focused on visual appearance and content quality but was also evaluated in terms of feasibility, practicality, and effectiveness, so that the results could be justified both theoretically and practically. Based on the synthesis of the three models, this study adopted a development framework referred to as the Haldi Model**,** which consists of the following stages, as illustrated in Figure 1 below :

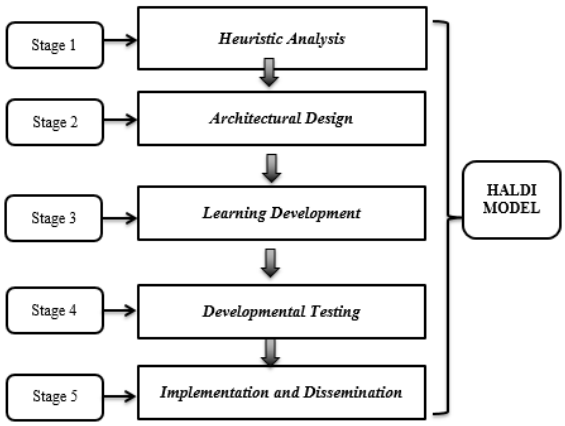

Figure 1. Development Model Flow

1) H (Heuristic Analysis)
   This stage is adapted from the initial investigation phase in the Plomp model and the analysis phase in the ADDIE model. Activities at this stage include identifying learning needs, analyzing student characteristics, and analyzing material in the Network Service Technology subject.
2) A (Architectural Design)
   This stage refers to the design phase of the Plomp and ADDIE models. This stage involves designing the media structure, determining video content, storyboarding, and selecting the software to be used.

3) L (Learning Development)
   This stage is an adaptation of realization/construction (Plomp) and development (ADDIE). The focus of the activity is the process of creating video tutorial media according to the pre-designed design.
4) D (Developmental Testing)
   This stage adopts the principles of evaluation and revision (Plomp), evaluation (ADDIE), and the limited trial and revision emphasis of Borg & Gall. The developed video media is tested for feasibility through validation by material experts and media experts.
5) I (Implementation and Dissemination)
   This final stage adapts the implementation (ADDIE) and dissemination (Borg & Gall) phases. The revised video tutorial media is then implemented in learning activities to assess its effectiveness.

Data collection technique

The data collection techniques used in this study included observation, interviews, questionnaires, and documentation. Observations were conducted to identify learning conditions and students' responses during the implementation of the video tutorial media. Interviews were carried out with the subject teacher at the main research site to obtain in-depth information regarding learning needs and challenges encountered in the Network Service Technology practicum. Questionnaires were administered to material experts and media experts to evaluate the feasibility of the developed media. User response questionnaires were distributed to one subject teacher at the main research site and to students to assess the practicality and effectiveness of the video tutorial media. Documentation was used as supporting data to strengthen the research findings, including learning records and evidence of media implementation.

Research Instruments

A research instrument is a tool used by researchers to collect data in order to facilitate the research process and obtain optimal results in a more efficient, complete, and systematic manner (Arikunto, 2013). In this study, the instrument was developed in the form of a questionnaire using a five-point Likert scale. The scale ranged from 1, representing the lowest level of agreement, to 5, representing the highest level of agreement (Sugiyono, 2015). The instrument items were designed to measure key aspects of the developed tutorial video media, including content quality, technical quality, usability, and instructional effectiveness. The questionnaire was administered to material experts, media experts, and users (teachers and students) to obtain comprehensive evaluations from different perspectives. This approach ensured that the assessment results reflected both expert judgment and actual user experiences.

Data Analysis Techniques

Data collected from media experts, subject matter experts, teachers, and students through questionnaires were analyzed using descriptive analysis methods.

Descriptive statistics were employed to describe the data objectively without making generalizations. The questionnaire results were converted into percentage scores using a predetermined formula. The analysis results were used to determine the validity, practicality, and effectiveness of the developed video tutorial learning media for Network Service Technology practicum. The ideal score was calculated based on the assumption that each questionnaire item received the maximum possible score. All data were processed using Microsoft Excel and presented in the form of narrative explanations, tables, and percentage distributions to provide a clear and systematic description of the research findings.

3. Results and Discussion

This study aims to develop and examine the effectiveness of video tutorial learning media for the Network Service Technology practicum in Vocational High Schools. The development process employed the haldi model, consisting of Heuristic Analysis, Architectural Design, Learning Development, Developmental Testing, and Implementation and Dissemination, which were carried out systematically to ensure instructional and technical quality. The results focus on the main findings obtained from field trials that evaluated the media in terms of validity, practicality, and effectiveness. The findings indicate that the video tutorial media supports practical learning activities by improving clarity of procedures, learning independence, and student engagement. Overall, the results confirm that the developed media meets the requirements for effective implementation in vocational education learning contexts.

Analysis Phase

The analysis phase aimed to identify the learning needs and challenges encountered by teachers and students in the Network Service Technology learning process at State Vocational High School 6 Takalar and State Vocational High School 2 Makassar. Initial observations showed that learning activities were still dominated by lectures, brief demonstrations, and written worksheets. Consequently, students often experienced difficulties in remembering and understanding technical and sequential configuration procedures. These difficulties mainly occurred during network simulations using Cisco Packet Tracer, server virtualization with VirtualBox, and the configuration of Mini SIP Server services. This condition indicated that the learning methods and instructional media used had not optimally supported students in systematically comprehending practical procedures. Further observations and interviews revealed that students tended to be less active during learning sessions and frequently struggled to follow technical steps when explanations were delivered verbally. Teachers also expressed the need for more engaging and effective learning media to support students' understanding of network configuration processes. Based on these findings, the identified learning needs emphasized the development of video tutorial media that integrates text, visual illustrations, audio narration, and practical demonstrations, enabling students

to learn independently and master configuration steps in a structured and sequential manner.

Design Phase

This stage refers to the design phase of the Plomp and ADDIE models, which aims to design the structure and main components of the video tutorial media prior to the production stage. At this stage, the overall media design is formulated, beginning with determining the learning content, organizing the flow of material presentation, and developing initial visualizations through a storyboard. This stage also involves selecting the software to be used in producing the video tutorial, including screen recording and video editing applications, Cisco Packet Tracer for network simulation activities, VirtualBox for virtual machine demonstrations, and a Mini SIP Server as required in Network Service Technology practicum learning.The media structure is designed to ensure that the material is presented systematically and is easy to follow by Grade XII students of Computer and Network Engineering programs. The video content is determined based on the core competencies and practicum materials of Network Service Technology that require clear and direct demonstrations. A storyboard is developed to describe the sequence of visual displays in the video tutorial media. Each scene is explained in detail, including configuration screen displays, supporting visuals, placement of explanatory text, and narration that accompanies the video, to ensure clarity and instructional effectiveness.

Development Phase

This stage is an adaptation of the realization or construction stage in the Plomp model and the development stage in the ADDIE model. At this stage, the video tutorial media design is implemented into a complete and functional product. The development process involves recording network configuration activities, editing video footage, preparing instructional narration, and integrating visual and audio elements to ensure that the tutorial videos are clear and easy for students to follow. All development activities are directed toward producing learning media that are systematic, well-structured, and aligned with the instructional needs of the Network Service Technology practicum. The results of the video tutorial media development are presented in several visual displays, as shown in Figures 2 below:

Figure 2. The opening screen of the video tutorial

Figure 3 shows the main process of a video tutorial, which includes an explanation and demonstration of the configuration using the application used, such as Cisco Packet Tracer or VirtualBox. This section explains the steps, from creating the topology, setting network parameters, to testing the configuration results

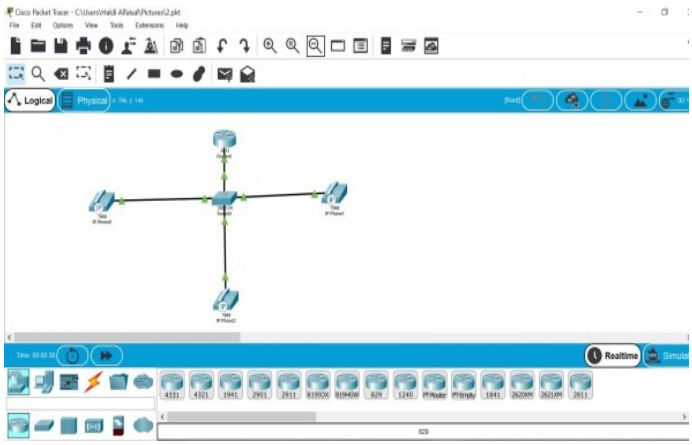

Figure 3. Display configuration steps

Figure 4 shows the practice questions and the video tutorial conclusion.

Figure 4. practice questions display and video conclusion

Developmental Testing Phase

To ensure the feasibility of the product before full implementation, product testing and revision were conducted through several stages, namely individual trials, small group trials, large group trials, and comprehensive field trials. Each trial stage was used to evaluate the practicality and effectiveness of the developed video tutorial media in the Network Service Technology Practicum subject.

The first stage was an individual trial involving three Grade XII students at State Vocational High School 6 Takalar representing low, medium, and high ability levels. The individual trial aimed to identify students' initial responses to the video tutorial media, the clarity of usage instructions, ease of operation, and students' level of understanding of the presented material. Based on the results of the individual trial, the practicality aspect obtained a score of 12.30 with a final average score of 4.16 and a final percentage of 83%, indicating that the video tutorial media was categorized as very practical. Meanwhile, for the effectiveness aspect, a score

of 12.7 was obtained with a final average score of 4.26 and a final percentage of 85%, which falls into the very effective category.

The next stage was a small group trial involving ten Grade XII TKJ students at State Vocational High School 6 Takalar. This trial aimed to assess the practicality of the media in a small classroom environment, particularly in terms of ease of use, clarity of menu navigation, video display quality, and students' ability to follow practicum steps. In addition, the small group trial was also used to evaluate the effectiveness of the media in supporting students' understanding of the material and increasing student engagement in the learning process. The results of the small group trial showed that the practicality aspect achieved a total score of 45.38 with a final average score of 4.51 and a final percentage of 90%, which is categorized as very practical. For the effectiveness aspect, a total score of 44.5 was obtained with a final average score of 4.47 and a final percentage of 89%, indicating that the video tutorial media was very effective.

The subsequent stage was a large group trial involving thirty Grade XII TKJ students at State Vocational High School 6 Takalar. The large group trial was conducted to examine the practicality and effectiveness of the video tutorial media in a larger classroom setting that closely resembles actual learning conditions. The observed practicality aspects included ease of media use in a classical setting, clarity of video display, and smoothness of media utilization during practicum activities. Meanwhile, the effectiveness aspect focused on students' comprehension of the material, implementation of practicum activities, and the role of the media in helping students achieve learning objectives. Based on the results of the large group trial, the practicality aspect obtained a final average score of 4.26 with a final percentage of 85%, which is categorized as very practical. For the effectiveness aspect, a total score of 133.8 was obtained with a final average score of 4.41 and a final percentage of 88%, indicating that the video tutorial media was very effective.

The final stage was a comprehensive field trial conducted at State Vocational High School 6 Takalar and State Vocational High School 2 Makassar. This field trial aimed to evaluate the practicality and effectiveness of the video tutorial media under real learning conditions in different school contexts. The results of the field trial at State Vocational High School 6 Takalar showed that the practicality aspect achieved a total score of 256.9 with a final average score of 4.25 and a final percentage of 85%, which is categorized as very practical, while the effectiveness aspect obtained a total score of 251.7 with a final average score of 4.18 and a final percentage of 84%, which is categorized as very effective. Meanwhile, the field trial results at State Vocational High School 2 Makassar indicated that the practicality aspect achieved a total score of 297.6 with a final average score of 4.28 and a final percentage of 86%, categorized as very practical, and the effectiveness aspect obtained a total score of 293 with a final average score of 4.23 and a final percentage of 85%, categorized as very effective. Thus, based on all trial stages conducted, from individual trials to comprehensive field trials, it can be concluded that the developed video tutorial media meets the criteria of being very practical and very effective. Therefore, the media is suitable for use as a learning medium in the Network Service Technology Practicum subject at Vocational High Schools.

Implementation Phase

This implementation phase adopted the implementation stage of the ADDIE model and the dissemination stage of the Borg & Gall model. The revised video tutorial learning media was implemented in learning activities at State Vocational High School 2 Makassar and State Vocational High School 6 Takalar. The media was applied in Grade XII Network Service Technology practicum lessons. Teachers used the video tutorials as a visual guide before students carried out network configuration activities, as an independent learning resource for students who experienced difficulties in following practical procedures, and as reinforcement material prior to completing practicum tasks.

During the implementation process, students showed greater learning independence. They were able to replay parts of the video that were not yet understood, which reduced their dependence on direct teacher explanations. The use of video tutorial media also supported a more structured practicum process, as students followed configuration steps in a more systematic manner. The effectiveness of the implementation was reflected in improved accuracy in following configuration procedures, a decrease in basic configuration errors during practicum activities, and better practicum performance compared to learning conditions before the use of the video tutorial media. The overall results of the implementation of the video tutorial learning media for the Network Service Technology practicum are presented in Table 1 below:

Table 1. Practicality test results

Respondent	Assessment Aspect	Average Score	Category
SMK Negeri 2 Makasar	Technical Quality, Usability and Language	4,28	very practical
SMK Negeri 6 Takalar	Technical Quality, Usability and Language	4,25	very practical
Teacher	Technical Quality, Usability and Language	4,69	very practical

Based on Table 1, the results of the practicality test show that the developed media received a very practical rating from all respondents. Respondents from SMK Negeri 2 Makassar gave an average score of 4.28, while SMK Negeri 6 Takalar gave a score of 4.25, both of which are included in the very practical category. In addition, teachers as the main users gave the highest average score, namely 4.69, also in the very practical category. These results indicate that the learning media has good technical quality, is easy to use, and uses clear language, making it feasible and practical to be applied in the learning process. The results of the effectiveness of the development of Video Tutorial Media on Network Service Technology Practice Material in Vocational High Schools can be seen in Table 2 below:

Table 2. Effectiveness test results

Respondent	Assessment Aspect	Average Score	Category
SMK Negeri 2 Makasar	Learning Quality, Incentives	4,23	very effective
SMK Negeri 6 Takalar	Learning Quality, Incentives	4,18	very effective
Teacher	Learning Quality, Incentives	4,79	very effective

Based on Table 2, the effectiveness test results indicate that the developed learning media is categorized as very effective. Respondents from SMK Negeri 2 Makassar gave an average score of 4.23, while respondents from SMK Negeri 6 Takalar gave a score of 4.18, both of which are included in the very effective category. Meanwhile, teachers gave the highest average score of 4.79, also in the very effective category. These findings indicate that learning media can improve the quality of learning and provide motivation (incentives) to students, making it effective for use in learning activities.

Discussion

The Heuristic Analysis Stage (Initial Analysis) consists of two main components, namely Performance Analysis and Needs Analysis. The results of the Performance Analysis indicate that learning activities in Network Service Technology are still dominated by lecture-based methods, limited demonstrations, and the use of written worksheets. As a result, students experience difficulties in understanding and remembering the procedural sequence of technical configuration steps required in practicum activities. These difficulties are particularly evident during network simulation and virtualization practices using Cisco Packet Tracer, Virtual Box, and Mini APP as supporting tools in learning. This condition indicates that the existing instructional approach has not fully facilitated students' procedural understanding and hands-on competence in systematically performing network configuration tasks.

Furthermore, the Needs Analysis results reveal that students require learning media in the form of video tutorials that are capable of presenting configuration procedures clearly, systematically, and sequentially. Video tutorial media are considered essential because they can be accessed and replayed repeatedly at any time, allowing students to independently review each configuration step according to their individual learning pace and learning needs, especially when using simulation and practicum tools such as Cisco Packet Tracer, Virtual Box, and Mini APP.

The Architectural Design Stage refers to the design phase adopted from the Plomp and ADDIE models. This stage functions to design the overall structure, content organization, and main components of the video tutorial media prior to the production process. At this stage, learning objectives, instructional flow, visual layout, narration structure, and practicum sequences are carefully planned to ensure

that the developed media aligns with the characteristics of vocational high school students and the demands of Network Service Technology learning.

The Learning Development Stage represents an adaptation of the realization or construction stage in the Plomp model and the development stage in the ADDIE model. At this stage, the previously designed video tutorial media is developed into a complete and functional product. The development process includes recording network configuration activities, editing video footage, composing instructional narration, and integrating visual and audio elements. These components are arranged to ensure that the video tutorial media is clear, systematic, and easy for students to follow during practicum activities using Cisco Packet Tracer, Virtual Box, and Mini APP.

The Developmental Testing Stage was conducted to evaluate the practicality of the developed video tutorial media at State Vocational School 6 Takalar and State Vocational School 2 Makassar. Practicality evaluation involved expert validation and user response assessments. The instrument expert lecturer evaluation obtained a total score of 110 with a final average score of 5.00 and a percentage of 100%, while the media expert lecturer evaluation obtained a total score of 130 with a final average score of 5.00 and a percentage of 100%. Both results fall into the very feasible category. In addition, material expert evaluation conducted by two vocational school teachers resulted in a total score of 9.55 with a final average score of 4.79 and a percentage of 96%, which is categorized as very feasible.

User response evaluation was conducted involving both students and teachers as users of the media. The teacher user response for the practicality aspect obtained a final average score of 4.69 with a percentage of 94%, indicating a very practical category. These results show that the developed video tutorial media is easy to use, flexible, accessible via computers and smartphones, and can be replayed multiple times to support the implementation of practicum activities in Network Service Technology learning.

The Implementation and Dissemination Stage is the stage in which the revised video tutorial media is implemented in learning activities at State Vocational School 6 Takalar and State Vocational School 2 Makassar. At this stage, effectiveness testing was conducted based on teacher user responses. The effectiveness evaluation obtained a final average score of 4.79 with a percentage of 96%, which is categorized as very effective. These findings indicate that the developed video tutorial media effectively supports students' understanding of practicum materials and assists teachers in facilitating both independent and guided learning processes. Therefore, the video tutorial media is proven to be very feasible, very practical, and very effective for use in Network Service Technology learning at vocational high schools.

4. Conclusion

This study successfully developed and evaluated video tutorial media for the Network Service Technology practicum in vocational high schools using the HALDI development model. The findings indicate that the developed media demonstrates a high level of feasibility, practicality, and effectiveness. Feasibility evaluation conducted by an instrument expert lecturer, a media expert lecturer, and teachers as subject matter experts confirmed that the video tutorial media meets technical, content, and instructional requirements and is categorized as very feasible. Practicality testing was conducted through user response evaluations involving both teachers and students as users of the media in the learning process. The results show that the video tutorial media is categorized as very practical, indicating that it is easy to use, flexible, and accessible via computers and smartphones. The ability to replay the videos repeatedly supports teachers in managing practicum learning and facilitates students' independent practice during Network Service Technology activities.

Furthermore, effectiveness testing based on user responses from both teachers and students demonstrated that the video tutorial media is very effective in supporting practicum learning. The media enhances students' understanding of practicum procedures, supports both guided and self-directed learning, and assists teachers in delivering systematic and sequential network configuration instruction. Overall, the developed video tutorial media serves as a feasible, practical, and effective learning resource that bridges theoretical concepts and practical implementation, strengthens vocational students' technical competencies, and supports the learning demands of Network Service Technology in vocational high schools.

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