1st BICONE (Bhinneka Conference)
Empowering Society 5.0: Education, Technology, and Social Transformation
Vol 1 No 1 , 2025

PENGEMBANGAN MEDIA PEMBELAJARAN MOBILE -BASED LEARNING BERBASIS E-MODUL DALAM MATA PELAJARAN DASAR-DASAR PROGRAM KEAHLIAN TEKNIK JARINGAN KOMPUTER DAN TELEKOMUNIKASI TKJ-X DI SMK PGRI KRAS KEDIRI

Fiska Puji Lestari[1)], Anggara Sukma Ardiyanta[2)]
1. Information Technology Education, Faculty of Science and Technology, Universitas Bhinneka PGRI, Indonesia
Email address: fisikapujilestarilestari@gmail.com
2. Information Technology Education, Faculty of Science and Technology, Universitas Bhinneka PGRI, Indonesia
Email address: anggaraardiyanta@gmail.com

Abstract - This research is motivated by the low interactivity of learning media used in the subject of Basic Principles of Computer and Telecommunications Network Engineering (TJKT) for 10th-grade students at SMK PGRI Kras Kediri. The conventional learning process makes students less active and has difficulty understanding the material. This study aims to develop mobile-based learning media in the form of an e-Module that can be accessed via Android devices using the Smart Apps Creator application.
This research method uses the 4-D development model (Define, Design, Develop, Disseminate). Data collection instruments were validation questionnaires from media experts and material experts, as well as student response questionnaires to assess the product's validity and practicality. The validation results show that the developed learning media is in the very valid category, with percentages from media expert 1 at 84%, media expert 2 at 94%, and a material expert at 87%. The practicality tests on small and large groups showed results of 89% and 90%, respectively, which are included in the very practical category. Based on these results, the e-Module learning media is declared feasible and effective for use in the learning process of TJKT Basic Principles, and it supports the implementation of the Independent Curriculum.
Keywords: E-Module, Mobile-Based Learning, Learning Media, Smart Apps Creator, TJKT

I. INTRODUCTION

The advancement of technology in today's digital era has had a profound impact on various aspects of human life, ranging from communication to business. Technology has now become an integral part of daily activities. Rapid developments in information and communication technologies such as the internet, mobile devices, and cloud-based systemhave accelerated the exchange of information, expanded access to knowledge, and transformed the ways in which people work, interact, and learn.

Technology plays a crucial role in education by expanding access to learning resources, enabling flexible environments, and promoting interactive and creative teaching. As a result, integrating technology into education is now essential. Digital learning involves the use of technological tools both as instructional methods and learning media. One major aspect affected by technological advancement is learning media, which refers to tools or technologies used to deliver messages from teachers to students, serving as channels for knowledge, ideas, and skills.

E-modules are a form of digital teaching material designed to support teachers in facilitating the learning process of students[1]. As a systematically organized learning medium, e-modules enable students to learn independently while developing problem-solving skills[2]. The existence of e-modules plays a strategic role in delivering teaching materials, while offering a number of advantages over printed learning media, particularly due to their interactive nature. Additionally, the ease of access through devices such as laptops, smartphones, or computers makes e-modules a relevant and effective alternative in fostering the development of students' critical thinking skills.

With the progress of digital technology, technology-based learning media have emerged as an innovative approach capable of enhancing students' learning interest,

expanding the scope of instructional content, and strengthening students' active engagement in the learning process. Learning media are an integral part of the educational system and can serve as one of the indicators of the achievement of educational objectives. [3]. One of the emerging technologies that has attracted significant attention in the field of education is mobile learning, which offers flexibility and personalization, allowing for more adaptive learning experiences. This is evident in the ability of adaptive mobile learning to facilitate learning anytime and anywhere, while also accommodating individual learners' needs and preferences.

The subject Fundamentals of TJKT Skills Program is a core subject in vocational schools specializing in information and communication technology that equips students with basic knowledge of computer networks and data communication systems. This subject plays a strategic role in the Merdeka Curriculum because it strengthens students' basic competencies before they delve into specific skills, and trains them to think logically and systematically in solving technical problems.

However, field observations indicate that the learning outcomes for this subject remain suboptimal. Data from observations in class X TJKT 1 at SMK PGRI Kras reveal that the average student score in this subject was only 76.1 lower than other subjects such as Informatics (81.6), IPAS (77.0), and Physical Education (PJOK) (82.5). This is particularly concerning given that almost all students own Android-based smartphones. Unfortunately, the use of technology in the learning process remains limited to conventional media, such as PDF files containing material summaries and practice questions. This suggests that the integration of digital technology in learning has not been optimal, which in turn affects students' motivation and academic performance.

There is a growing need for interactive and engaging learning media that suit the characteristics of today's digital generation. Android-based mobile technology offers a promising solution due to its open-source nature, ease of development, and accessibility. Mobile e-modules can facilitate self-directed and collaborative learning while enhancing critical thinking and problem-solving skills. This approach aligns with the Merdeka Curriculum's emphasis on student-centered learning.

Based on this rationale, the study is titled: "Development of Mobile-Based Learning Media Using E-Modules for the Subject Fundamentals of Computer and Telecommunications Network Engineering (TJKT-X) at SMK PGRI Kras Kediri." This research aims to contribute to improving learning quality through the creation of relevant, effective, and innovative digital media.

II. RESEARCH METHODS

This research was conducted within the Study Program of Information Technology Education, Faculty of Science and Technology, Universitas Bhinneka PGRI Tulungagung. The research method employed is Research and Development (R&D), which involves the process of developing a new product or improving an existing one, followed by testing the effectiveness of the final product. [4]. Within this method, a specific model is used as a reference for product development. The model adopted in this study is the 4D model, which consists of four development stages: Define, Design, Develop, and Disseminate [5].

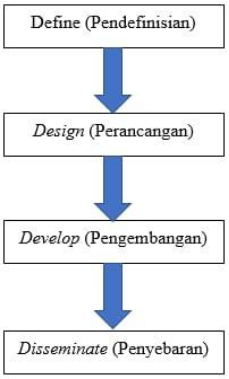

Figure 1 model

In the Define stage, several analyses are conducted, including needs analysis, learner analysis, task analysis, concept analysis, and the formulation of learning objectives. This stage aims to identify problems and determine the subject matter and competencies to be developed in the learning media.

The Design stage involves the development of assessment instruments, selection of media and formats, and the creation of the initial product design. During this stage, the media is designed to align with learners' characteristics and learning objectives, including the integration of interactive elements to enhance student engagement. In the Develop stage, the product is created based on the initial design and subsequently validated by media experts and subject matter experts. Limited trials and field testing are then conducted to gather feedback from users (students), which is used to revise and refine the product. The Disseminate stage is the final phase, which aims to distribute the developed product. At this stage, the media is disseminated to a broader user base so that it can be utilized in actual learning environments. The instruments used in this research include media expert validation questionnaires, material expert validation questionnaires, and student response questionnaires. Data analysis was conducted using quantitative descriptive techniques to determine the validity and practicality levels of the developed product.

III. RESULTS AND DISCUSSION

berikut ini adalah deskripsi tentang pengembangan yang telah dilakukan menggunakan tahap 4D:

A. define stage

The Define stage serves as the initial step in the 4D development model, focusing on the identification of needs and preliminary analyses as the foundation for developing learning media. In this stage, the researcher conducted five types of analysis: preliminary analysis, learner analysis, task analysis, concept analysis, and learning objective analysis. The results of the preliminary analysis revealed that the learning process for the subject Fundamentals of Computer and Telecommunication Network Engineering (DPK) for Grade X at SMK PGRI Kras still relies on PDF-format materials, which tend to lack interactivity. This has caused students to focus more on completing assessments rather than understanding the content, resulting in a low comprehension of core materials, such as business process concepts in the field of computer network and telecommunication engineering. Based on classroom observation, the average student score in DPK was only 76.1, which is lower than other subjects such as Informatics (81.6) and Physical Education (PJOK) (82.5).

Learner analysis was conducted through observations and interviews with the subject teacher. The findings indicated that all students owned Android-based smartphones; however, there was no learning media that effectively utilized the potential of these devices. Teachers expressed the need for more engaging and interactive media to increase student participation.

Task and concept analyses were carried out by referring to the Merdeka Curriculum and the Learning Objectives Flow (ATP). The content focused on is "Business Processes in the Field of Computer Network and Telecommunication Engineering," which includes planning, customer needs analysis, installation and configuration, and strategies to maintain customer satisfaction. The module is designed with an approach that enables students to understand the relationship between technical and business aspects within the networking industry.

Learning objectives were formulated to ensure that students not only understand the material but are also able to apply it independently and professionally in real-world work contexts. These objectives are also intended to enhance students' critical thinking and problem-solving skills. Referring to the 4D model developed by Thiagarajan et al[5]. the Define stage serves as the primary foundation for guiding the design and development of the mobile learning-based e-module. The clarity in identifying needs and learner characteristics at this stage is crucial in determining the relevance and effectiveness of the developed instructional media.

B. Design Stagee

The Design stage represents the initial phase of instructional media planning, based on the needs analysis conducted in the previous stage. During this phase, the researcher begins to outline the framework for media development, which includes the formulation of learning objectives, strategies for content delivery, selection of media formats, and the development of evaluation instruments. The design of the instructional media is carried out by taking into account the characteristics of the learners, the alignment of the material with the curriculum, and the principles of mobile-based learning.

Following the analysis process, the researcher proceeded to design the application product. The instructional media was developed in the form of an Android-based application to support flexible learning anytime and anywhere. The application was designed using Smart Apps Creator (SAC), a platform that enables the development of interactive multimedia content and is suitable for use as a learning medium.pembelajaran[6]. The instructional media was developed in the form of an Android-based application to support flexible learning anytime and anywhere. The application was designed using Smart Apps Creator (SAC), a platform that enables the development of interactive multimedia content and is suitable for use as a learning medium, by integrating interactive elements such as text, images, navigation buttons, quizzes, and instructional videos to enhance student engagement.

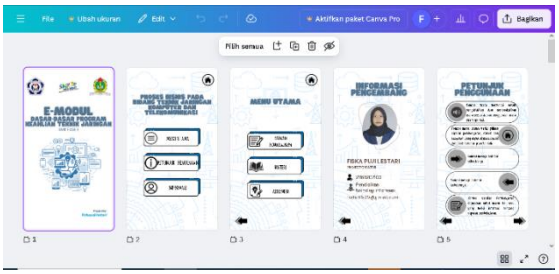

Figure 2 Adding assets in the Smart Apps Creator on Canva

The initial design of this media was created with the help of the Canva application. Using Canva as a design tool can make it easier for teachers to create attractive media displays and save time in the development processThe [7]. design process also includes selecting buttons that are appropriate for the product's functions and developing user interaction flows. Once the algorithms and design elements have been implemented, the application is prepared to respond to user input intuitively and efficiently.

C. Develop stage

this stage, researchers developed learning media products using Smart Apps Creator software. The

designed products were then systematically compiled into a single application called "E-Modul Proses Bisnis" (Business Process E-Module).

The result of this development stage was the creation of products that met the criteria of validity and practicality. This is in line with the opinion [7]. which states that the development stage aims to produce a product that is ready for use.

The following is a preview of the educational media that has been developed:

Figure 3 Title Page

Figure 3, The title page is the application's opening screen, which serves as the gateway to the menu page. On this page, users can start exploring the application with just one tap anywhere on the screen, or by swiping the screen in any direction.

Figure 4 Menu page

Figure 4 Menu page, displaying three main buttons: Main Menu, User Guide, and User Information. The Main Menu button is used to access pages containing Learning Objectives (LO) / Learning Objective Flow (LOF), materials, and assessments. The User Guide button directs users to a page containing guidelines for using the application. Each page is equipped with a Back button that allows users to easily return to the previous page.

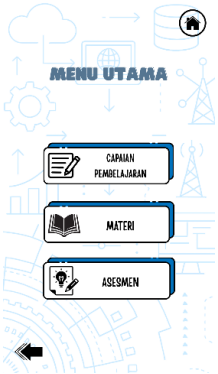

Figure 5 Main menu page

Figure 5 Menu page, displaying three main buttons, namely Main Menu, User Guide, and User Information. The Main Menu button is used to access pages containing Learning Objectives (LO)/Learning Objective Flow (LOF), materials, and assessments. The User Guide button directs users to a page containing guidelines for using the application. Each page is equipped with a Back button that allows users to easily return to the previous page.

Figure 6 developer information

Figure 6 developer information, displaying information about the profile of students as creators of learning media, which aims to provide users with an overview of the background of the media developers.

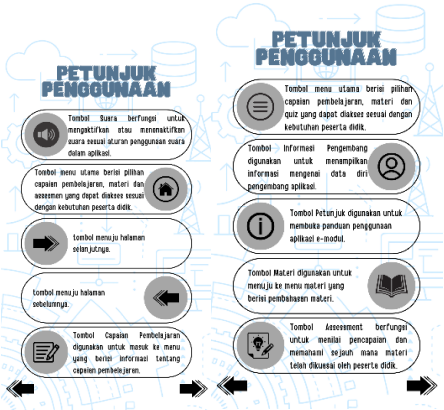

Figure 7 user manual page

Figure 7 shows the user manual, which contains information about the functions of the buttons in the application. With this user manual, both teachers and students will find it easier to understand how to operate the media, thereby supporting the smooth running of the teaching and learning process.

Figure 8 learning outcomes and learning objectives page

Figure 8 Learning outcomes. This page displays the learning objectives that refer to Phase E in the Merdeka Curriculum implemented at SMK PGRI Kras Kediri. The information presented includes learning outcomes and learning objectives designed to support a systematic and focused learning process.

Figure 9 material page

Figure 9 Course material page. This course material menu page presents the materials to be studied first. This page contains buttons/menus to navigate to the next materials.

Figure 10 video page

Figure 10 video pages, this application presents material on the Basics of Computer Network and Telecommunications Engineering in the form of videos taken from YouTube. Each chapter of the material contains one concise and informative video to facilitate understanding.

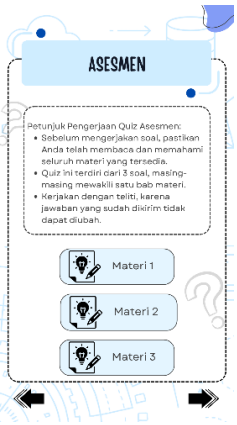

Figure 11 assessment page

The assessment page contains a collection of questions designed to measure students' abilities after studying the material through learning media. The assessment is conducted using Google Forms, so that students' work is automatically sent to the teacher's email for assessment.

This mobile-based learning media using e-modules was tested on 10th grade TKJ students at SMK PGRI Kras. Before being tested, the media was first validated by media experts and subject matter experts. Validation was conducted by a lecturer in Information Technology Education at Bhineka PGRI Tulungagung University as media expert 1, a lecturer in Computer Science as media expert 2, and the subject teacher as the subject matter expert. After that, the media was tested through small-group and large-group trials.

TABLE I. VALIDITY TEST

Media Expert	Material Expert
94%	87%

Category "Highly Recomended"	Category "Highly Recomended"

Based on Table 1, the assessment by media experts received a score of 94%, while subject matter experts received a score of 87%. Therefore, it can be concluded that both received a rating of "Very Good."

D. Dissemination Stage

Dissemination Stage At this stage, the completed and developed e-module products are disseminated. The dissemination process is assisted by teachers of the Basic Computer Network and Telecommunications Engineering Skills Program, who share the e-module application files through the WhatsApp group for the Basic Computer Network and Telecommunications Engineering Skills Program class. This dissemination is targeted at students in class X TJKT 1 and is conducted during the Basic Computer Network and Telecommunications Engineering Skills Program learning activities in the classroom. As part of the limited-scale dissemination phase, the results of this research are also presented in the form of a scientific article and have been published.

IV. CONCLUSION

A. The development process for this e-module-based learning media uses the 4D development model (Define, Design, Develop, and Disseminate). In the Define stage, needs analysis is conducted through observation and interviews. The Design stage produces a design for the media flow, interface display, and e-module-based content tailored to the curriculum. During the Develop stage, the media is created using the Smart Apps Creator application and validated by subject matter experts and media experts. Finally, the Disseminate stage involves limited testing with students in small groups (5 people) and large groups (26 people) to assess the effectiveness and acceptability of the media.

B. T he feasibility level of the e-module-based learning media developed showed excellent results. Validation by media expert I obtained a score of 84% with a "highly feasible" qualification, media expert II obtained a score of 94% with a "highly feasible" qualification, and validation from the subject matter expert obtained a score of 80% with a "feasible" qualification. The results of the small-group trial achieved a score of 89%, and the large-group trial achieved a score of 90%, both of which fall under the "highly suitable" category. Therefore, it can be concluded that the development of this mobile-based e-module learning media is valid and suitable for use as an alternative learning medium at SMK PGRI Kras Kediri. This media not only enriches the teaching methods for the "Fundamentals of Computer Networking and Telecommunications Skills Program" in the classroom but also has the potential to enhance the effectiveness and quality of the teaching-learning process through the use of technology that aligns with the characteristics of the current digital generation.

V. DAFTAR PUSTAKA

[1] E. A. Astri *et al.*, "ANASLISIS KESULITAN BELAJAR PESERTA DIDIK DALAM MEMAHAMI MATERI SEJARAH DI KELAS XI IPS."

[2] L. P. E. Diantari, L. P. E. Damayanthi, N. S. Sugihartini, and I. M. A. Wirawan, "Pengembangan E-Modul Berbasis Mastery Learning Untuk Mata Pelajaran KKPI Kelas XI," *J. Nas. Pendidik. Tek. Inform.*, vol. 7, no. 1, p. 33, 2018, doi: 10.23887/janapati.v7i1.12166.

[3] M. M. Nurzaelani, R. Kasman, and S. Achyanadia, "Pengembangan Bahan Ajar Integrasi Nasional Berbasis Mobile," *JTP - J. Teknol. Pendidik.*, vol. 20, no. 3, pp. 264–279, 2018, doi: 10.21009/jtp.v20i3.8685.

[4] B. Muqdamien, U. Umayah, J. Juhri, and D. P. Raraswaty, "Tahap Definisi Dalam Four-D Model Pada Penelitian Research & Development (R&D) Alat Peraga Edukasi Ular Tangga Untuk Meningkatkan Pengetahuan Sains Dan Matematika Anak Usia 5-6 Tahun," *Intersections*, vol. 6, no. 1, pp. 23–33, 2021, doi: 10.47200/intersections.v6i1.589.

[5] Thiagarajan, S., Semmel, D. S., & Semmel, M. 1. (1974). Instructional Development For Training Teachers Of Exceptional Children: A Sourcebook. In Indiana University: Bloomington, Indiana, Https://Doi.Org/10.1016/0022-4405(76)90066-2

[6] A. R. Azizah, "Penggunaan Smart Apps Creator (SAC) untuk mengajarkan global warming," *Pros. Semin. Nas. Fis. Unesa*, vol. 4, no. 2, pp. 72–80, 2020.

[7] Rahma Elvira Tanjung, "Rahma Elvira Tanjung, 2019 Canva," vol. 7, no. 2, 2019.