Development of Website-Based E-Learning for Computer System Material

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Abstract. The results of the study indicate that the web-based computer system e-learning is effective in terms of content, language, and design. Additionally, the media was deemed practical and effective for students. The study involved tenth-grade students at SMKN 1 Kwanyar. Data on student learning resources were collected using interviews. Subsequently, the product was tested on students through three stages: individual testing, small group testing, and field testing. The research trial subjects included 3 students for individual testing, 12 students for small group testing, and 35 students for field testing. Data collected in this research included evaluations from content experts, design experts, learning media experts, and student trials. The development of the computer system e-learning for tenth-grade students at SMKN 1 Kwanyar showed the following results: Feedback from content experts (relevant subject teachers) achieved a 91% level of achievement. Feedback from e-learning system experts achieved a 93% level of achievement. Field test results achieved a 92% level of achievement, categorized as excellent. The development of the computer system e-learning for tenth-grade students at SMKN 1 Kwanyar is categorized as excellent, making the e-learning platform suitable for use in learning.

Keywords: E-Learning, Website, Computer System.

1 Introduction

The Era of the Industrial Revolution 4.0 presents significant challenges in the field of education. As stated in Law No. 20 of 2003, Article 3, education plays a crucial role in developing human resources and keeping up with the evolution and changes of the times. In efforts to develop human resources, many innovations leverage technology to simplify tasks, including in education. Technological advancements have impacted education, particularly in learning, where information and communication technology are now maximized to improve educational quality. Proper and appropriate use of technology can make teaching and learning activities more efficient and effective. The advancement of technology facilitates the learning process and, undoubtedly, influences learning outcomes [4]. According to [6], education also needs to adapt to current technological developments. Devices such as computers and smartphones can be used as supporting tools in teaching and learning activities between teachers and students and as media for communication and information delivery.

In the learning process, educational media refers to tools that are well-organized and designed to convey messages and build social connections. Educational media includes various items or materials in their original form, printed materials, audiovisual media, multimedia, and the internet. These tools must be designed and innovated to meet students' learning needs. Communication plays a crucial role in the learning process. To ensure effective communication between teachers and students and for students to understand the information delivered by teachers, educational media must be utilized. Learning through media will be effective if there is proper communication between teachers as information sources and students as recipients [5]. Consequently, innovative use of educational media can enhance students' critical thinking skills during the learning process, contributing to quality education. This is supported by [7], who stated in their research that the creation of educational media by teachers aims to increase the effectiveness and efficiency of the teaching-learning process. Hence, the development of creative and innovative learning models is necessary to ensure that classroom activities become more engaging, less monotonous, and enjoyable for students, allowing knowledge transfer to occur optimally.

Among various media utilized to enhance quality education is the use of technology in the learning process. The role of technology in learning is to facilitate, optimize, and significantly assist the learning process. Therefore, efficient and effective technology-based educational media that can be accessed anywhere and anytime is needed. One such efficient and effective medium is web-based learning. Besides leveraging existing technology, websites are easily accessible and flexible in terms of time and location.

Based on observations conducted at schools, researchers found that during classroom learning, teachers predominantly used teaching modules and occasionally employed PowerPoint presentations, making the process less optimal. This approach tends to make students passive, as they focus more on the teacher with minimal active engagement during classroom learning. This situation can impact students' learning motivation and outcomes.

Interviews with 10th-grade TKJ (Computer and Network Engineering) students and their teachers at SMKN 1 Kwanyar revealed that in vocational subjects, teachers primarily use teaching modules as guides and explain material using textbooks or handbooks. Additionally, teachers often rely on lectures to deliver lessons, leading students to feel bored and struggle to understand the material, ultimately affecting their learning outcomes. Specifically, computer system material is often perceived as challenging, yet it is foundational and essential before delving deeper into computer networks. This material requires a deeper understanding because it is fundamental and includes components that demand critical thinking, such as HOTS (Higher-Order Thinking Skills) questions that must be understood and solved. Therefore, a medium is needed to help students grasp the material more easily. However, there is currently no specific supporting teaching material for computer system topics. Thus, students need innovative and engaging resources to stimulate their learning interest.

To address this issue, one solution is to create engaging teaching materials that students can utilize effectively to understand the lessons delivered by teachers. E-learning is a significant innovation in transforming the learning process. Learning is no longer limited to face-to-face meetings and listening to teacher explanations but also involves students participating in various activities such as observing, performing, demonstrating, and engaging in interactive remote learning [1]. Among these, web-based media stands out. Websites are media that can be used to convey information flexibly and understandably to audiences. Websites are widely used to share information such as news, announcements, learning materials, and more. Learning through

websites offers several advantages, including quick access and flexibility in terms of time and location. This learning approach provides an efficient and effective learning experience. Additionally, students can smoothly engage in learning activities as they are connected to the internet. Websites can present information more efficiently and are continuously updated.

The media developed by the researcher focuses on computer system material, aiming to facilitate teachers in delivering material in class. Moreover, this media is designed to attract students' interest in learning, reduce their boredom during classroom lessons, and enhance their ability to utilize technology in education.

2 Research Method

The research model used is a type of Research & Development (R&D) research, where this method is employed to produce specific products and test their effectiveness [8] using the 4D development model (Define, Design, Development, Dissemination). The 4D model is a systematically designed framework that involves a series of logical activities related to learning resources. This framework aims to address learning problems in accordance with the needs and characteristics of students [2]. According to [3], the 4D development method features steps that are easy to understand, enabling completion within a short period. With its systematic development flow and lack of repetition, this method is suitable for creating educational media. The resulting product can be directly utilized to support students' learning activities.
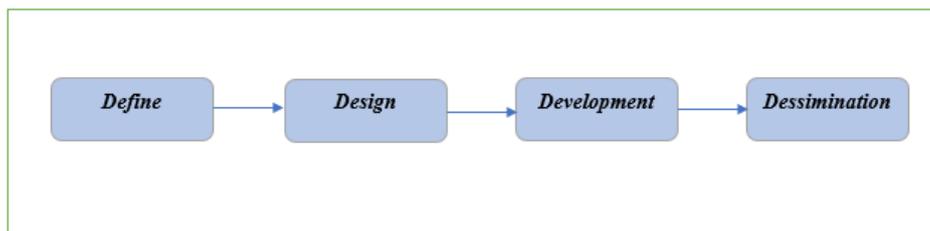

Fig. 1. 4D Research Method.

2.1 Define Stage

This stage serves as the initial phase, involving a needs analysis for development and the required specifications. The purpose of this stage is to identify and define the problems and determine the necessary solutions. Surveys and analyses are conducted to identify suitable learning media that meet the needs for enhancing students' critical thinking skills. Additionally, a literature study is carried out by gathering various documents, references, books, internet sources, and other resources necessary to design and implement the application system to be developed.

2.2 Design Stage

In the system design phase, the main goal is to develop ideas or concepts for the planned website. This process begins with creating use case diagrams, activity diagrams, and sequence diagrams. Next, a style guide is established for the user interface (UI), serving as a reference for designers in designing and building the website's interface.

2.2.1 Use Case Diagram

A Use Case Diagram illustrates how one or more actors interact with the information system being developed. Below is the representation of the Use Case

Diagram designed for the creation of the educational technology website. For the admin user, the primary tasks include adding, updating, and deleting users.
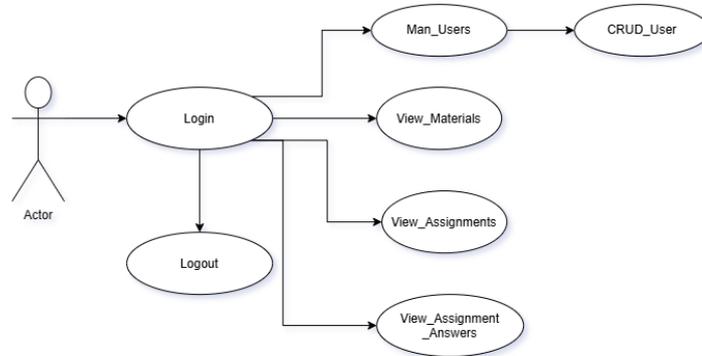

Fig. 1. Usecase admin.

In the teacher's user role, the teacher can add, update, and delete both materials and assignments. They can also grade student assignment answers.
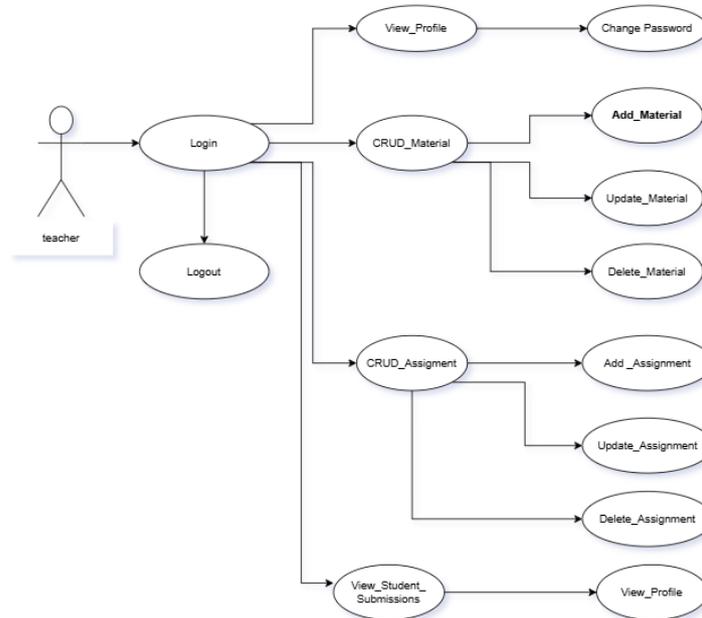

Fig. 3. Usecase teacher.

In the student's user role, students can access materials and assignments and download them. Additionally, students can change their password and profile picture.
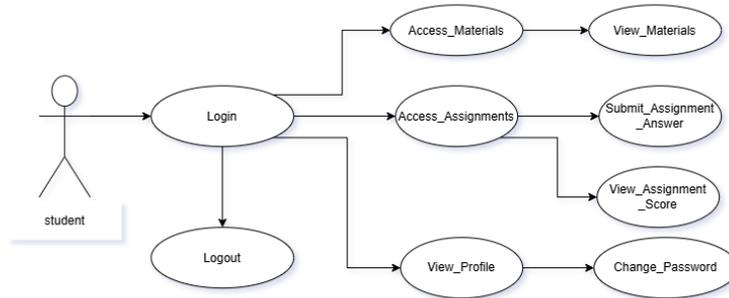
Fig. 4. Usecase student.

2.2.2 Activity Diagram

The activity diagram visualizes the overall flow of the program, from the process of opening the website to closing the website.
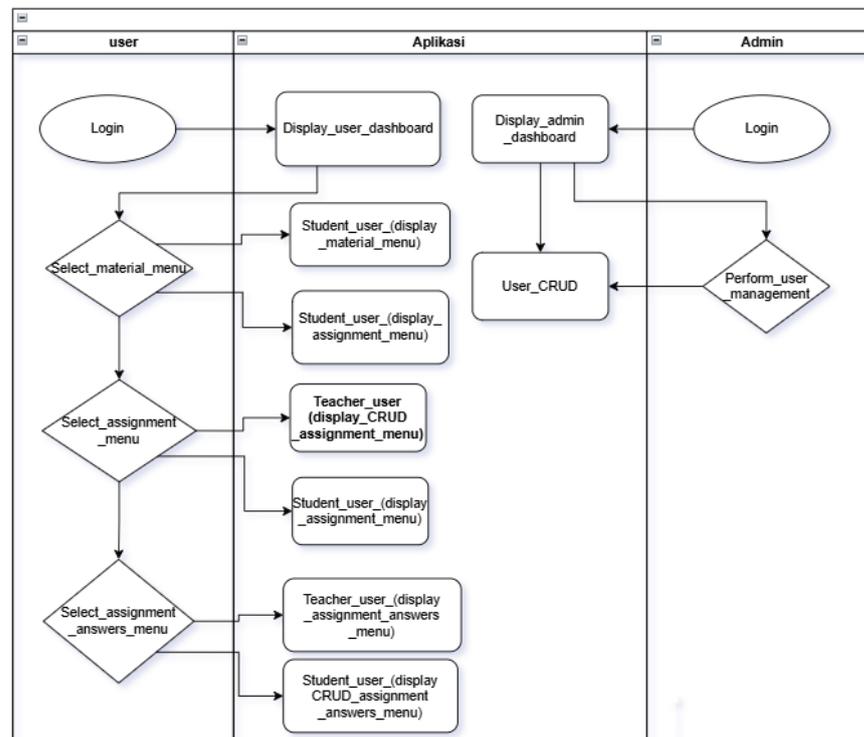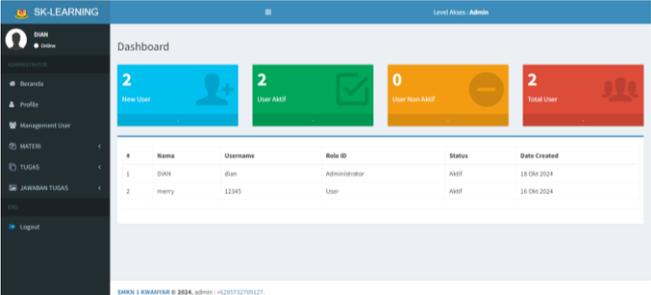

Fig. 5. Activity diagram.

2.2.3 User Interface (UI)

In the system design process, it starts with creating a user interface style guide as a guideline for designers in designing the web interface.

Table 1. User interface.

No	Design View	Description
1.		Design interface view of the login page
2.		Design interface view of the admin dashboard.
3.		Design interface view of the teacher dashboard.
4.		Design interface view of the student dashboard.

No	Design View	Description
5.	**Konfirmasi Logout** Klik logout untuk mengakhiri session [Logout] [Cancel]	Design interface view of the logout menu.

2.3 Development Stage

In this stage, the implementation of the previous designs takes place. The development process uses Visual Studio Code software with PHP programming language and the CodeIgniter framework.

2.4 Dessimination Stage

The final stage is the application of e-learning media as a learning tool to enhance the critical thinking skills of students in the TKJ class X at SMKN 1 Kwanyar. In this stage, all activities are documented to be used for future improvements related to the e-learning media. Evaluation is also conducted in this phase. The data collection technique used is by distributing questionnaires related to the learning process and the learning media needs during lessons. Subsequently, the e-learning media is developed as a web-based learning tool. The developed learning media will be tested through expert review in the expert review phase. The results will be revised, and product trials will be conducted to collect data that will form the basis for determining the effectiveness, efficiency, and appeal of the product. The data collection instruments used are: 1) Instrument for the need for learning media usage. 2) Media validation sheet. 3) Material validation sheet. 4) Student response questionnaire. The data analysis techniques used in the application development in this study include qualitative and quantitative data analysis.

3 Result And Discussion

The next stage after the development of e-learning is to conduct expert validation of the media in terms of appearance, efficiency, and software, with the results shown in Figure 6. Based on the results of this media expert validation, it can be concluded that this learning media is categorized as highly valid, with an average validation score of 93%.
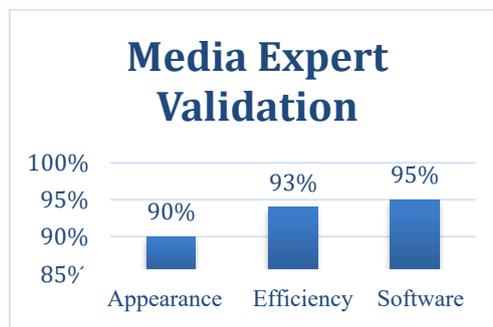
Fig. 6. Media expert validation.

The next stage after the development of e-learning is to conduct expert validation of the material in terms of content, materials, and questions, with the results shown in Figure 7. Based on the results of this material expert validation, it can be concluded that this learning media is categorized as highly valid, with an average validation score of 91%.

Fig. 7. Material expert validation.

The final stage is to conduct product testing of the e-learning system with students in terms of appearance, content, and efficiency using a student response questionnaire. This trial was conducted at SMKN 1 Kwanyar in class X TKJ B, with 35 students. Prior to this, individual trials with 3 students and small group trials with 12 students had been conducted. The results of this trial are shown in Figure 8. The average result was 92%, which falls within the very valid category.
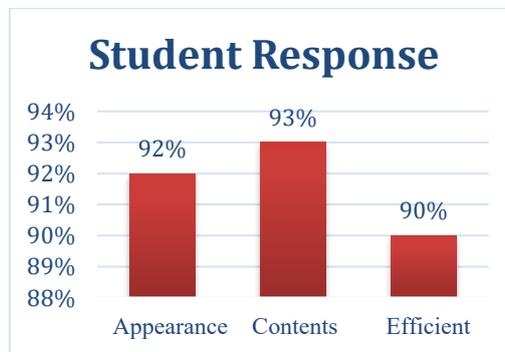

Fig. 8. Student response results.

4 Conclusion

Based on the results and discussion above, it can be concluded that this e-learning media can assist the learning process, as it received a very positive response from the students. This e-learning media system can also be used by students outside of class hours because it can be accessed via smartphones owned by the students. Teachers are also facilitated by this e-learning, as they can provide materials and collect assignments in a systematic manner. Based on the media validation results, an average score of 93% was obtained, categorized as highly valid, and the material validation received an average score of 91%, also categorized as highly valid. The

student response to this e-learning media resulted in an average score of 92%, indicating that the development of the e-learning system for class X at SMKN 1 Kwanyar is in the very good category, making this e-learning system suitable for use in learning.

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