

***DESIGN AND CONSTRUCTION OF A WEB-BASED ONLINE LEARNING
SYSTEM USING A MYSQL DATABASE***

**RANCANG BANGUN SISTEM PEMBELAJARAN ONLINE BERBASIS WEB
MENGUNAKAN DATABASE MYSQL**

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ABSTRACT

The rapid development of information technology has driven the transformation of conventional learning into web-based online learning. However, not all educational institutions have sufficient resources and infrastructure to adopt large-scale e-learning platforms. This study aims to design and develop a web-based online learning system using the PHP programming language and a MySQL database to support learning activities in small-scale higher education institutions. The research method employed is software engineering using the Waterfall development model, which includes requirements analysis, system design, implementation, and testing stages. The system involves three main actors: Administrator, Lecturer, and Student, with features for user management, learning material management, assignments, quizzes, and learning assessment. The results of functional testing using the black-box method indicate that all system features operate in accordance with user requirements. This study contributes a simple e-learning system model that is easy to develop and implement in educational institutions with limited technological infrastructure.

Keywords: Online Learning System, E-Learning, Web-Based Application, MySQL Database.

ABSTRAK

Perkembangan teknologi informasi yang pesat telah mendorong transformasi pembelajaran konvensional menuju pembelajaran daring berbasis web. Namun, tidak semua institusi pendidikan memiliki sumber daya dan infrastruktur yang memadai untuk mengadopsi platform e-learning berskala besar. Penelitian ini bertujuan untuk merancang dan membangun sistem pembelajaran online berbasis web menggunakan bahasa pemrograman PHP dan database MySQL yang ditujukan untuk mendukung proses pembelajaran pada lingkungan perguruan tinggi skala kecil. Metode penelitian yang digunakan adalah metode rekayasa perangkat lunak dengan model pengembangan Waterfall yang meliputi tahap analisis kebutuhan, perancangan sistem, implementasi, dan pengujian. Sistem melibatkan tiga aktor utama, yaitu Admin, Dosen, dan Mahasiswa, dengan fitur pengelolaan pengguna, materi pembelajaran, tugas, kuis, serta penilaian hasil belajar. Hasil pengujian fungsional menggunakan metode black box menunjukkan bahwa seluruh fitur sistem berjalan sesuai dengan kebutuhan pengguna. Penelitian ini berkontribusi sebagai model sistem e-learning sederhana yang mudah dikembangkan dan diimplementasikan pada institusi pendidikan dengan keterbatasan infrastruktur teknologi.

Kata Kunci: Sistem Pembelajaran Online, E-Learning, Website, Database MySQL.

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INTRODUCTION

The rapid development of information and communication technology has brought major changes to various sectors of life, including the education sector. The use of web-based technology is currently not only utilized as a medium for disseminating information, but has also developed into a main supporting medium in the learning process. Online learning systems or e-learning have become one of the innovations widely implemented to address the challenges of modern education, which demands greater flexibility, efficiency, and accessibility.

In conventional learning systems, the teaching and learning process is generally still conducted face-to-face in classrooms with limitations of space and time. These conditions often become obstacles, especially when the number of learners increases, learning time is limited, and learning materials need to be distributed quickly and evenly. In addition, the management of learning data, such as materials, assignments, grades, and student attendance, is still often carried out manually, which may lead to recording errors and ineffective data archiving.

A web-based online learning system is presented as a solution to overcome these problems. By utilizing web technology, the learning process can be carried out online so that lecturers and students do not have to be in the same place and at the same time. Lecturers can upload learning materials, provide assignments and quizzes, and conduct evaluations online. Meanwhile, students can access materials, complete assignments, and view assessment results anytime and anywhere as long as they are connected to the internet.

In order for an online learning system to run optimally, structured and integrated data management is required. MySQL database is used as a database management system because it is open source, easy to use, and capable of managing large amounts of data properly. The use of MySQL allows user data, learning materials, assignments, and grades to be stored centrally, making data management, searching, and maintenance easier.

Several previous studies have shown that web-based e-learning systems can improve the flexibility and effectiveness of learning. Wahyudi and Nugroho (2019) developed a web-based e-learning system to support the distribution of learning materials and learning evaluation. Another study by Sari et al. (2021) showed that the use of a Learning Management System (LMS) can increase student participation in online learning. However, most of these studies used relatively complex LMS platforms that require server infrastructure and adequate technical resources.

To date, studies discussing the development of simple and lightweight web-based online learning systems specifically designed for educational institutions with limited technological resources are still limited. Therefore, this study aims to fill this research gap by designing a web-based online learning system using PHP and MySQL that is easy to develop, implement, and maintain.

This study provides a scientific contribution to the design of a simple and adaptive web-based online learning system for small-scale higher education environments. Unlike existing e-learning platforms such as Moodle or Google Classroom, the system developed in this study does not depend on third-party services and can be customized according to institutional needs. The main contribution of this study lies in the integration of core learning features into a lightweight PHP- and MySQL-based platform that is easy to implement in environments with limited technological infrastructure.

METHODS

1. Type and Research Approach

This study is a software engineering research using a design and development method. The purpose of this research is to produce a product in the form of a web-based online learning system.

2. System Development Method

The system development model used in this study is the Waterfall model, which consists of the following stages:

1. System requirements analysis
2. System design
3. System implementation
4. System testing

The Waterfall model was chosen because it provides a systematic and structured development flow, making it suitable for the development of an online learning system.

Nonfunctional Requirements

The nonfunctional requirements of the system include:

- User data security through a login authentication system
- System performance capable of handling multi-user access
- Ease of use through a user-friendly interface
- Accessibility through a web browser

Core Database Structure

Several main tables used in the system include:

- User table
- Class table
- Learning material table
- Assignment and quiz table
- Grade table

a. System Requirements Analysis

This stage was conducted to identify the functional and nonfunctional requirements of the system. The system requirements include:

- Administrator: Managing user data, classes, and subjects
- Lecturer: Managing learning materials, assignments, quizzes, and grades
- Student: Accessing learning materials, completing assignments and quizzes, and viewing assessment results

b. System Design

At this stage, the system was designed using UML diagrams such as Use Case Diagram, flowchart, and MySQL database design to describe the system structure and workflow.

Use Case Diagram

The Use Case Diagram is used to describe the interaction between users or actors and the online learning system. This diagram shows the main functions that can be accessed by each actor according to their roles. In this web-based online learning system, there are three main actors: Administrator, Lecturer, and Student.

The Administrator has access rights to manage user data, classes, and subjects. The Lecturer is responsible for managing learning materials, assignments, quizzes, and evaluating student learning outcomes. The Student acts as a user who can access learning materials, complete assignments and quizzes, and view grade results.

The Use Case Diagram helps developers and users understand the functional requirements of the system comprehensively and serves as a basis for the system design and implementation process.

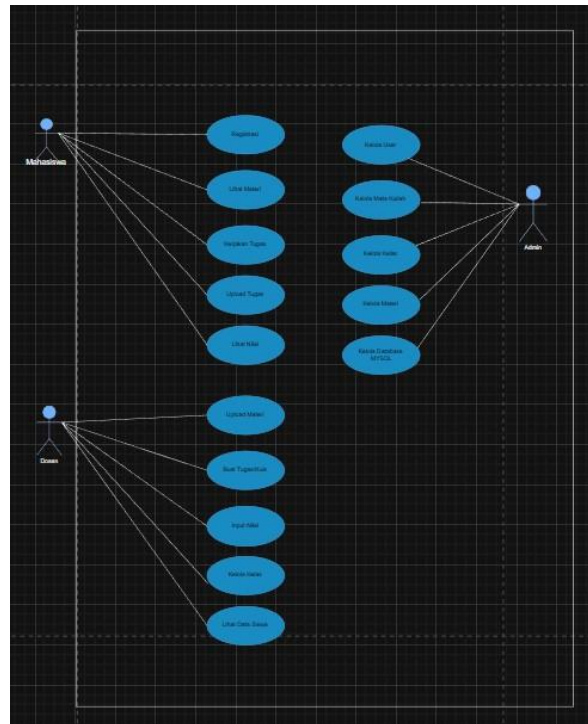


Figure 1. Use Case Diagram

FlowChart

The Flowchart is used to visually describe the process flow or working logic of the online learning system. It shows the process steps starting from user login until the system displays the output.

The main system flow begins with the user login process. After successful login, the system displays a menu according to the user's role. The Administrator is directed to the user and system data management menu, the Lecturer is directed to the material and assessment management menu, while Students are directed to the material and assignment access menu. This flowchart helps in understanding the system workflow and minimizing errors during system development and testing.

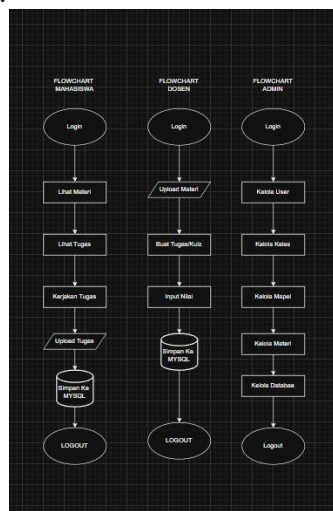


Figure 2. Flowchart

c. System Implementation

The implementation of this web-based online learning system was carried out using a web-based development environment. The programming language used was PHP as server-side scripting, while MySQL was used as the database management system to store and manage learning data. The web server used was Apache, integrated in the XAMPP package. The system was accessed through web browsers such as Google Chrome or Microsoft Edge.

3. Research Tools and Materials

The tools and materials used in this study include hardware in the form of a computer or laptop, and software in the form of an operating system, web server (XAMPP), PHP programming language, MySQL database, and web browser for application testing.

System Testing

Tool testing was carried out to ensure that all hardware and software used in the development and testing of the web-based online learning system functioned properly and supported optimal system performance. This tool testing aimed to determine the readiness of the testing environment before the system was fully used.

The hardware used in this study was one computer or laptop that functioned as a medium for system development and testing. Testing was conducted by ensuring that the hardware was able to run the web server, database, and web browser simultaneously without significant performance issues.

The software used included the operating system, Apache web server included in the XAMPP package, PHP programming language, MySQL database, and web browser. Software testing was carried out by running each component to ensure that no system conflicts occurred and that all services could run normally.

In addition, testing was also carried out through a web browser to ensure that the system could be accessed properly, the interface appeared correctly, and all features could be used according to their designed functions. Based on the testing results, all tools used were declared to function properly and were suitable for supporting the testing of the web-based online learning system.

System testing was conducted using the black box testing method to ensure that each function worked according to user requirements.

Table 1. System Functional Testing

| Actor | Feature | Expected Result | Status |
|---------------|----------------------------|---------------------------------------|------------|
| Administrator | Manage user data | Data are stored correctly | Successful |
| Lecturer | Upload learning materials | Materials can be accessed by students | Successful |
| Lecturer | Create assignments/quizzes | Assignments and quizzes are displayed | Successful |
| Student | Complete quiz | Grades are displayed | Successful |
| Student | Access materials | Files can be downloaded | Successful |

The testing results show that all system functions run according to the design.

RESULTS AND DISCUSSION

The web-based online learning system developed in this study has proven capable of addressing problems in conventional learning, particularly limitations of time, place, and distribution of learning materials.

The use of web technology enables the learning process to be conducted online and

flexibly. Lecturers can manage learning materials and evaluations efficiently, while students can access materials and complete assignments anytime as long as they are connected to the internet.

The utilization of MySQL database provides advantages in learning data management because data are stored in a structured, integrated, and secure manner. This reduces the risk of recording errors that often occur in manual systems and improves the efficiency of academic data archiving.

In addition, the application of Use Case Diagram and Flowchart at the design stage proved helpful for developers in understanding system requirements comprehensively. These diagrams served as clear guidelines in the implementation process so that the developed system met user needs.

Overall, the research results show that this web-based online learning system is feasible to be used as a supporting medium for online learning and can improve the quality of technology-based learning in educational environments.

a. Login Page Interface

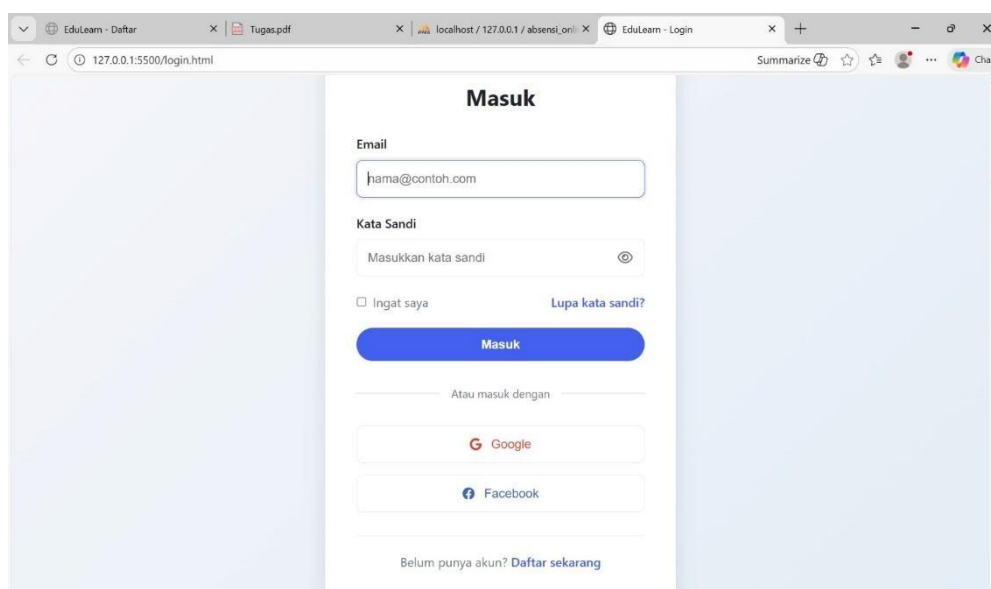


Figure 3. Login Page

The login page shows that this page is used to log in or access the EduLearn system for users who already have an account.

b. Registration Page Interface

The Registration Page is used by new users to create an account in the EduLearn system. Users are required to fill in several important data fields so that the account can be stored correctly and securely.

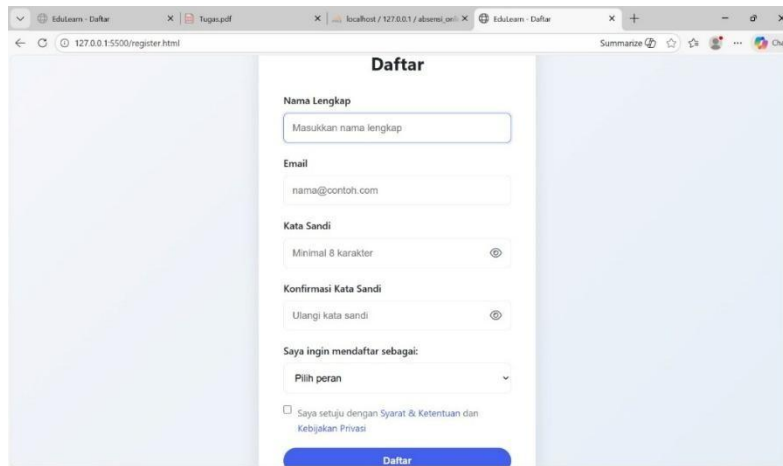


Figure 4. Registration Page

c. Main Page / Dashboard Interface

The Learning Dashboard Page is the main page that appears after the user successfully logs in. This dashboard serves as the information center for user learning activities in the EduLearn system.

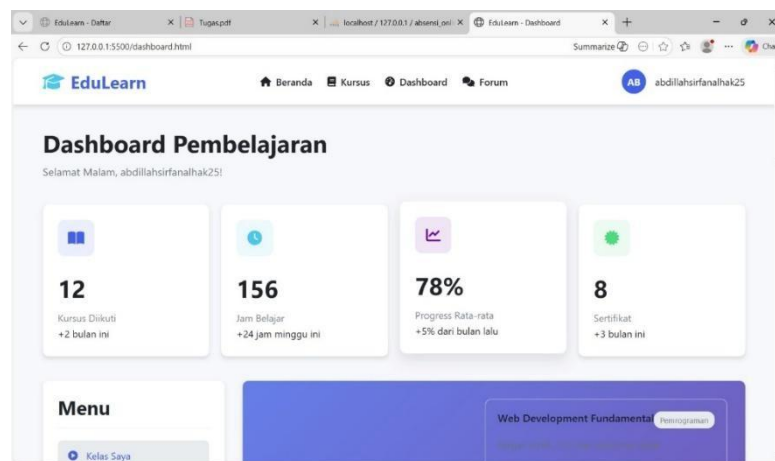
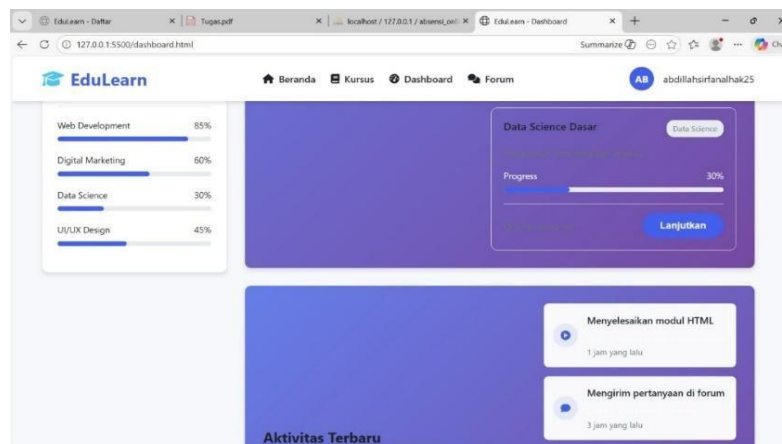


Figure 5. Dashboard Page

d. Class Page Interface

This page functions as a control center for students to monitor learning activities.



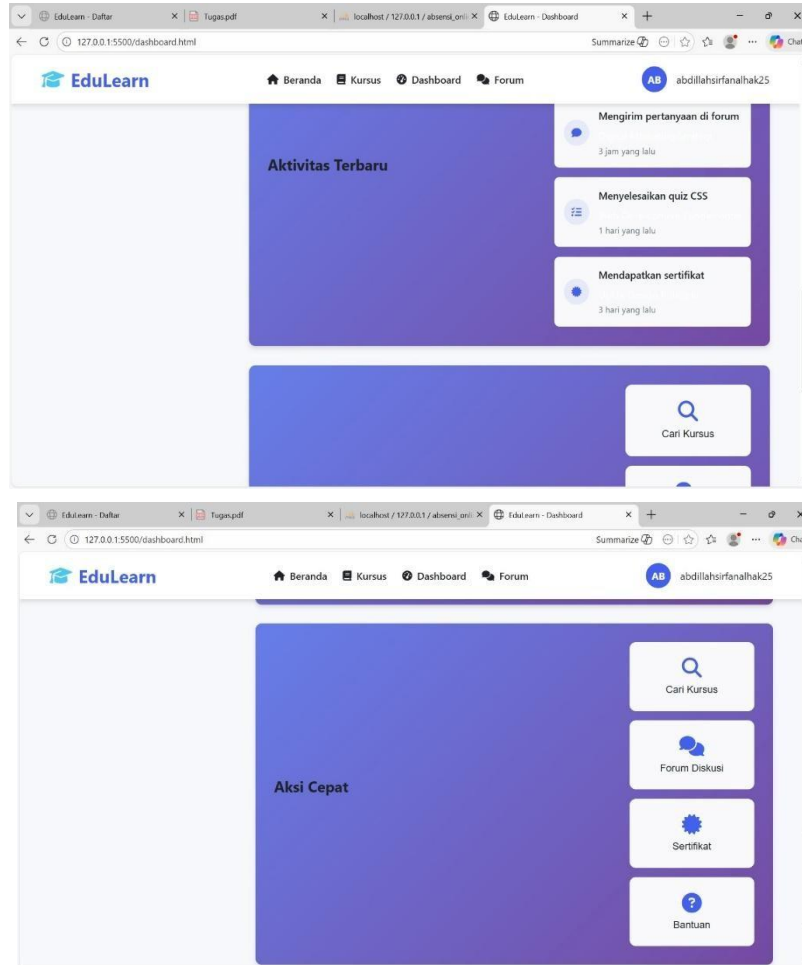


Figure 6. Class Activity Page

e. Logout Page Interface

The Logout Page is used to end the session of a user who is currently logged into the system.

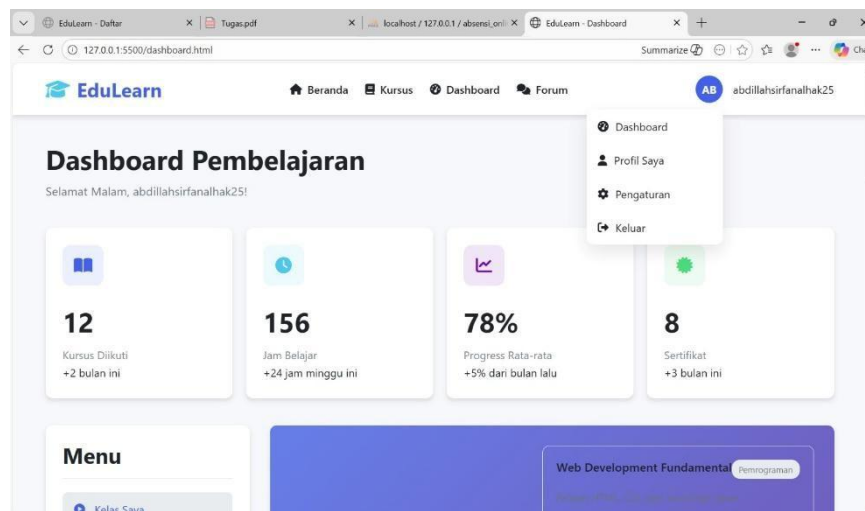


Figure 7. Logout Page

The result of this study is the development of a web-based online learning system designed to support the online teaching and learning process. The system was developed using PHP as server-side scripting and MySQL as the database management system. This system can be accessed through a web browser, so it does not require special installation on the user's device.

The resulting online learning system involves three main actors, namely Administrator, Lecturer, and Student, each with different access rights and functions according to their respective roles.

Implementation Results of Administrator Features

The Administrator has the role of the main system manager. Based on the implementation results, the Administrator can:

- Manage user data, including Administrator, Lecturer, and Student
- Manage class and subject data
- Manage user access rights in the system

Implementation Results of Lecturer Features

The Lecturer plays a role in managing the learning process. The successfully implemented features include:

- Uploading and managing learning materials
- Creating and managing online assignments and quizzes
- Assessing student assignment and quiz results
- Viewing student learning outcome reports

With these features, lecturers can conduct learning and evaluation activities without having to meet students face-to-face.

Implementation Results of Student Features

The Student features successfully implemented include:

- Accessing and downloading learning materials
- Completing assignments and quizzes online
- Viewing grades and learning evaluation results

System Strengths

1. The system is lightweight and easy to implement.
2. The system does not depend on third-party services.
3. The system can be customized according to institutional needs.

System Limitations

1. The system does not yet support a mobile application version.
2. The system does not yet provide automatic notification features.
3. The system has not yet been integrated with payment systems or video conferencing technology.

Comparison with Other Systems

Compared with Moodle and Google Classroom, this system is simpler and suitable for institutions with limited infrastructure. However, the system has more limited features.

CONCLUSION

Based on the results of the design, implementation, and testing of the web-based online learning system using a MySQL database, it can be concluded that the developed system was successfully built and runs properly according to user requirements. This system

is able to support the online learning process effectively and efficiently.

This online learning system involves three main actors, namely Administrator, Lecturer, and Student, each of whom has different access rights and functions. The Administrator can manage user, class, and subject data; Lecturers can manage learning materials, assignments, quizzes, and assessments; while Students can access materials, complete assignments and quizzes, and view grade results online.

The use of PHP programming language and MySQL database has proven capable of managing learning data in a structured, integrated, and centralized manner, making it easier to store, process, and search data. In addition, the system can be accessed through a web browser without requiring additional installation, thereby increasing flexibility in the learning process.

The testing results show that all system features function properly and according to the design. Therefore, this web-based online learning system is feasible to be used as a supporting medium for online learning and is expected to become an alternative solution for improving the quality of technology-based learning in educational environments.

This study contributes by providing a simple, adaptive, and easy-to-develop web-based online learning system model for educational environments with limited infrastructure. This system can serve as an independent alternative solution for online learning.

Future research is recommended to develop the system into a mobile application, add real-time notification features, and integrate video conferencing technology.

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