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Developing a Web-Based Examination Feature for the MALIGO Learning Management System

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A B S T R A C T

Learning Management Systems have become an essential part of education in the digital era. At Politeknik Pertanian Negeri Payakumbuh, the existing Academic Information System has been used as the main learning platform; however, its broad and general scope has not adequately addressed the specific and complex needs of individual study programs, particularly during work-from-home and work-from-anywhere conditions. This study aimed to develop the LMS MALIGO platform for the Computer Engineering Technology Study Program, with a focus on a web-based examination feature. The study adopted an Agile methodology and employed validity and effectiveness testing for data analysis. The results showed that LMS MALIGO obtained a validity score of 0.73, which was categorized as valid, while the effectiveness score reached 0.30, indicating that the system was moderately effective. These findings suggest that LMS MALIGO can serve as a valid and reasonably effective learning platform, although several aspects still require improvement, particularly data security, user-friendly interface design, and the addition of mobile application and real-time collaboration features.

Abstrak

Sistem Manajemen Pembelajaran telah menjadi bagian penting dari dunia pendidikan di era digital. Di Politeknik Pertanian Negeri Payakumbuh, Sistem Informasi Akademik yang ada telah digunakan sebagai platform pembelajaran utama; namun, cakupannya yang luas dan umum belum cukup memenuhi kebutuhan spesifik dan kompleks dari masing-masing program studi, terutama selama kondisi kerja dari rumah dan kerja dari mana saja. Penelitian ini bertujuan untuk mengembangkan platform LMS MALIGO untuk Program Studi Teknologi Teknik Komputer, dengan fokus pada fitur ujian berbasis web. Penelitian ini mengadopsi metodologi Agile dan menggunakan pengujian validitas dan efektivitas untuk analisis data. Hasil menunjukkan bahwa LMS MALIGO memperoleh skor validitas sebesar 0,73, yang dikategorikan sebagai valid, sedangkan skor efektivitas mencapai 0,30, yang menunjukkan bahwa sistem tersebut cukup efektif. Temuan ini menunjukkan bahwa LMS MALIGO dapat berfungsi sebagai platform pembelajaran yang valid dan cukup efektif, meskipun beberapa aspek masih memerlukan perbaikan, terutama keamanan data, desain antarmuka yang ramah pengguna, serta penambahan fitur aplikasi seluler dan kolaborasi real-time.

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1. Introduction

Learning Management Systems (LMSs) have become an integral part of education in the digital era, particularly in supporting online instruction, content management, interaction between instructors and learners, and assessment processes (Pratama & Kusuma, 2021). As digital learning continues to expand, LMS platforms are increasingly expected not only to deliver instructional content but also to provide responsive, accessible, and efficient learning experiences. However, LMS platforms—especially those with limited free features—often

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face constraints that reduce their effectiveness in addressing specific instructional and assessment needs.

This issue has become more significant in the context of institutional budget-efficiency policies. In line with the policy direction stated in the Circular Letter of the Secretary General of the Ministry of Higher Education, Science, and Technology No. 4 of 2025, as well as the 2025 budget adjustment policy issued by Politeknik Pertanian Negeri Payakumbuh, higher education institutions are required to maintain learning quality and interaction under limited resource conditions (Kementerian Pendidikan Tinggi, Sains, dan Teknologi, 2025). The implementation of work-from-home and work-from-anywhere arrangements, while offering flexibility, may also create challenges in maintaining effective communication between lecturers and students, ensuring access to essential learning materials, and supporting practical instruction that requires specific hardware and software, particularly in the Computer Engineering Technology Study Program.

To address these challenges, Politeknik Pertanian Negeri Payakumbuh has attempted to optimize technology use in learning through the implementation of the Academic Information System (SIAKAD) as the main platform. However, because its scope is broad and administrative in nature, it has not been able to accommodate the specific and complex needs of individual study programs, especially under WFH/WFA conditions. This institutional limitation led to the initiative to develop MALIGO, a Learning Management System specifically designed for the Computer Engineering Technology Study Program.

MALIGO, which stands for *Modular Adaptive Learning Intelligent Growth Online*, is a web-based LMS developed using an agile approach. The agile method has been widely recognized as a flexible development approach that supports iterative improvement, user responsiveness, and adaptive system design (Aldisa & Abdullah, 2022; Hidayah & Asnadi, 2024; Zulvi, 2021). In addition, adaptive learning approaches have previously been shown to support more personalized and responsive learning environments in educational technology systems (Putra, 2021; Surahman & Surjono, 2017). In this context, MALIGO is intended to create a learning platform that is more flexible, interactive, and accessible for program-specific instructional needs.

One of the common limitations of free LMS platforms is insufficient interactivity. MALIGO addresses this issue by providing features such as discussion forums, a thesis repository, and a web-based examination feature intended to enhance learner engagement and support more efficient instructional management. In addition, the platform is designed to automate aspects of the assessment process so that learners can receive feedback more quickly and efficiently. Prior work has also shown that adaptive and intelligent LMS design can improve the responsiveness of digital learning systems by integrating learner needs more directly into platform functionality (Bhaskaran & Swaminathan, 2014). These features indicate that MALIGO is not merely a technical platform, but an instructional response to the academic and operational needs of the study program.

Despite these developments, the current literature and institutional practice still reveal several limitations. First, broad academic information systems such as SIAKAD do not sufficiently address program-specific instructional and assessment needs. Second, many LMS implementations emphasize general content delivery but do not fully integrate

interactive assessment features that are tailored to specific disciplinary contexts. Third, although agile development has been widely discussed in software and system design, its application in the development of specialized educational platforms remains less clearly documented in program-level learning environments. Therefore, a gap remains in the development of a web-based examination feature that is specifically designed within a program-oriented LMS and developed through an agile approach to support online learning under resource and interaction constraints.

The novelty of this study lies in the development of a web-based examination feature within the MALIGO Learning Management System, specifically designed for the Computer Engineering Technology Study Program at Politeknik Pertanian Negeri Payakumbuh. Unlike general institutional systems, this feature is intended to support a more adaptive, interactive, and efficient online assessment process in a program-specific learning environment.

Accordingly, this study aims to develop the web-based MALIGO Learning Management System by applying the agile method, evaluate the effectiveness of the agile approach in the development process, and identify the benefits and challenges of MALIGO use for both lecturers and students. Through this focus, the study is expected to contribute both practically and academically. Practically, it is expected to provide an effective learning-support feature, improve access to learning and assessment tools, and support institutional efficiency in LMS development and maintenance. Academically, it contributes to the discussion on the development of more responsive and program-specific digital learning systems in higher education.

2. Method

This study adopted an Agile-based development methodology to design and implement the MALIGO Learning Management System (LMS). In addition to system development procedures, the study employed validity and effectiveness testing as the main approaches to product evaluation [6]. This design was considered suitable because the study aimed to develop a web-based learning management system feature and to evaluate its quality and usefulness in an educational context

2.1. Research Context and Setting

The study was conducted in the context of Politeknik Pertanian Negeri Payakumbuh, where MALIGO was developed as a web-based Learning Management System to support program-specific instructional needs. The development process was intended to respond to institutional and instructional demands related to digital learning implementation.

2.2. Participants

The manuscript indicates that several types of users were involved during system implementation and evaluation, including administrators, lecturers, and students of Politeknik Pertanian Negeri Payakumbuh. In addition, user needs were identified through interviews in the planning stage.

2.3. Research Instruments

Data were collected using interviews and questionnaires**.** Interviews were conducted during the planning stage to identify the specific requirements of the LMS to be

developed, including desired features, workflows, and interface preferences [7]. Questionnaires were used as the main instrument for validity and effectiveness testing.

2.4. *Data Collection Procedures*

The study followed the stages of the Agile methodology, as illustrated in Figure 1. The stages are described as follows.

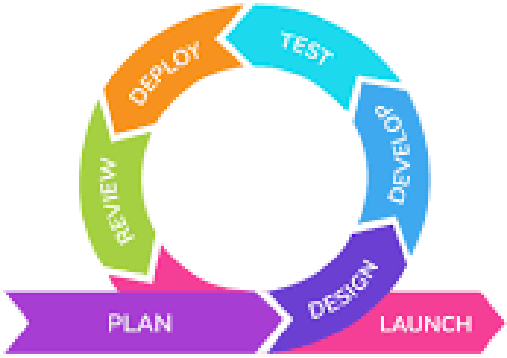


Figure 1. Stage of Agile Method

2.4.1. *Planning*

The planning stage involved gathering initial information about the LMS already used at Politeknik Pertanian Negeri Payakumbuh and identifying user needs through interviews. These interviews were conducted to determine the specific requirements of the LMS in detail, including expected features, preferred workflows, and interface preferences [7].

2.4.2. *Design*

The design stage of LMS MALIGO was conducted collaboratively with the development team and supervisors to ensure that all functional requirements were addressed. The design went through several iterations based on feedback, including layout revision, navigation refinement, and design optimization for accessibility and efficiency [8]. The final design served as the technical guide for the developers. The interactive and comprehensive user interface was designed using React.js, and it included important features such as course management, examination features, a thesis repository, and a KBK team feature.

2.4.3. *Development*

The development stage began using React.js and Strapi. To ensure a responsive display across devices, the Material UI framework was integrated as the main design foundation, and the system bundle was built using Vite [9].

2.4.4. *Testing*

The testing stage in Agile was conducted to evaluate the design from the user perspective. The purpose was to ensure that the system was easy to use, efficient, and satisfactory, particularly for administrators, lecturers, and students of Politeknik Pertanian Negeri Payakumbuh.

2.4.5. *Deployment*

The deployment stage involved the implementation of the website-based Learning Management System. At this stage, the system was applied for use by several categories of users, including administrators, lecturers, and students

2.4.6. *Review*

The review stage was a critical stage in software development. Its purpose was to evaluate the product and process in order to identify potential problems, provide feedback, and ensure quality [10]. At this stage, the review focused on the source code to identify bugs, performance issues, and violations of coding standards.

2.4.7. *Launch*

The launch stage referred to the release of the application or software system into the production environment so that it could be accessed and used by end users.

2.5. *Validity and Reliability*

In this study, product evaluation was conducted through validity and effectiveness testing using questionnaires as the data collection instrument. Validity testing aimed to ensure that the research instrument was accurate and measured what it was intended to measure, with a clear framework [11]. Validity was assessed through expert judgment and analyzed statistically using Aiken's V. A product was considered valid if the V value ranged from 0.60 to 1.00, whereas a value below 0.60 indicated insufficient validity [12].

2.6. *Data Analysis*

Two main forms of data analysis were used in this study.
First, validity analysis was conducted using Aiken's V based on expert judgment [12]. This analysis was used to determine whether the instrument and product had adequate validity.

Second, effectiveness analysis was conducted using Richard R. Hake's G-Score, also known as Normalized Gain (N-Gain), to examine the extent to which the product achieved its intended goals and provided meaningful benefits to users [13]. Based on the stated criteria, the product was categorized as less effective if the G-Score was below 29%, moderately effective if the G-Score was 30% or higher, and effective if the G-Score was within the 70–100% range [14]

3. Result and Discussion

3.1. Result

This study successfully developed the MALIGO Learning Management System (LMS) as a more flexible, interactive, and accessible platform for Politeknik Pertanian Negeri Payakumbuh. The results are presented according to the major stages of the Agile-based development process: planning, design, develop, testing, deployment, review, and launching. The section focuses on the main development outputs and product evaluation results.

3.1.1. Development Results

3.1.1.1. *Planning Stage*

At the planning stage, the development process consisted of project initiation and requirement gathering. Based on observations and interviews with

lecturers in the Computer Engineering Technology Study Program, the study identified a central problem: the existing LMS had a broad and general scope and was unable to accommodate the specific and complex needs of individual study programs, particularly under WFH/WFA conditions. Requirement gathering identified three major categories of needs: user needs, functional needs, and non-functional needs. User needs involved administrators, lecturers, and students, each with distinct roles in system management and use. Functional needs included both hardware and software requirements, while non-functional needs included database security, backup and restore functions, and cloud storage maintenance.

3.1.1.2. Design Stage

The design stage focused on structuring the assignment and examination-related features of the MALIGO Learning Management System. This phase involved user interface planning and system modeling to ensure that the system could accommodate the needs of administrators, lecturers, and students. Several UML-based design artifacts were produced to represent the structure and workflow of the system.

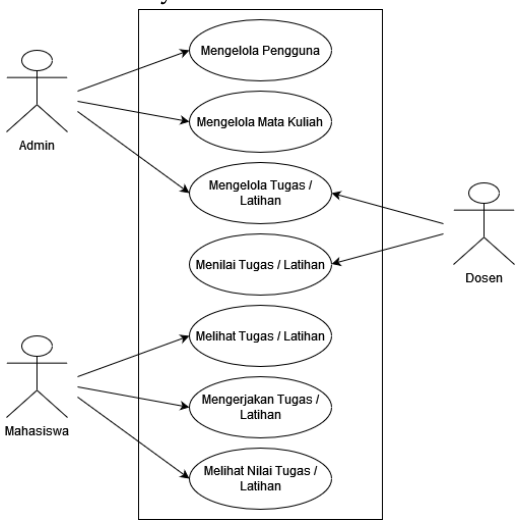


Figure 2. Presents The Use Case Diagram

In addition, Figure 2 shows the activity diagram, which illustrates the general workflow of the system. The activity begins with the login process and then branches according to the access rights of each user. Administrators manage users, courses, and assignments; lecturers manage and assess assignments; and students complete and review their assignments. This figure confirms that the interaction flow of the LMS was designed to support differentiated access and task execution based on user roles.

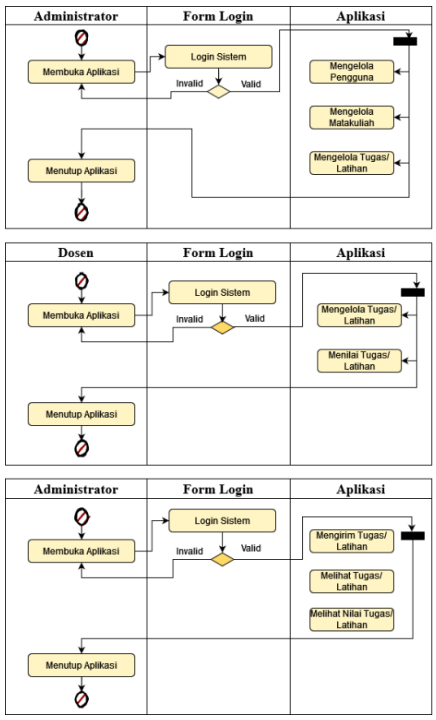


Figure 3. Activity Diagram

Figure 3 shows the activity diagram, which illustrates the workflow of the system. The activity begins with the login process and then branches according to the access rights of each user. Administrators manage users, courses, and assignments; lecturers manage and assess assignments; and students submit assignments and view their results.

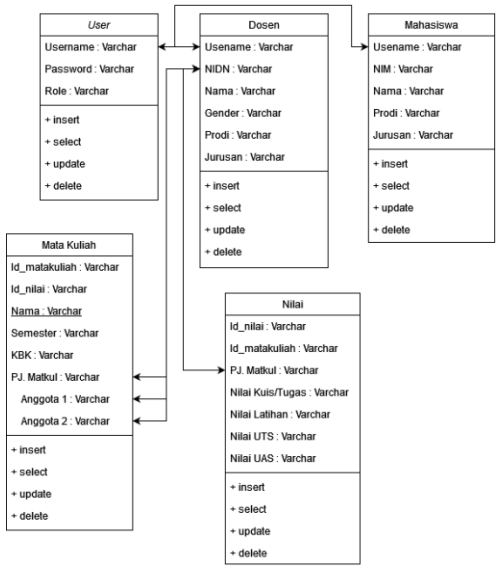


Figure 4. Class Diagram

Figure 4 displays the class diagram, which represents the static structure of the MALIGO system and the relationships among its entities. This diagram provides an overview of the main data structure that supports the operation of the system.

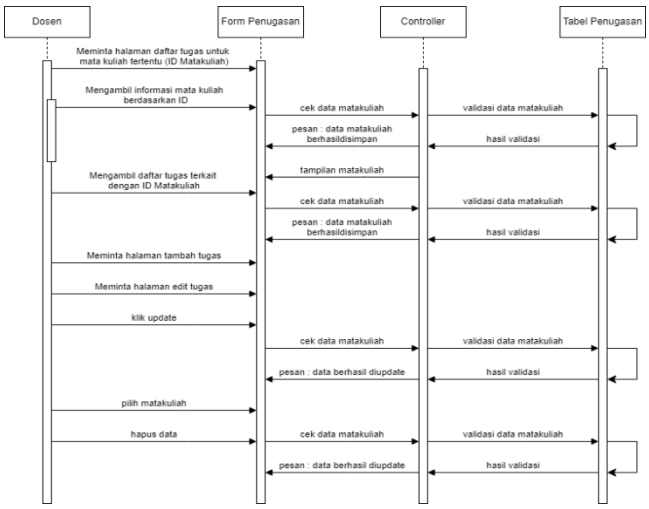


Figure 5. Sequence Diagram of the MALIGO LMS

Figure 5 shows the sequence diagram, which illustrates the chronological interaction among system components during system use. In this study, the sequence diagram demonstrates how specific functions, such as managing courses, managing assignments, or completing assignments, are processed within the MALIGO system.

3.1.1.3. *Develop Stage*

At the development stage, the system design was translated into a functional web-based product. The outputs of this stage included user authentication pages and examination interfaces for both lecturers and students. These interfaces represent the implementation of the system design into an operational LMS environment.



Figure 6. Sequence Diagram of the MALIGO LMS

Figure 6 presents the registration page used by lecturers and students to create accounts and access the system. On this page, users are required to enter their institutional identification number, email address, and password



Figure 7. Login Page

Figure 7 shows the login page, which allows registered users to access the MALIGO LMS through their credentials.

A key output of this study is the examination feature. On the lecturer side, Figure 8 presents the lecturer examination interface, which supports the full examination cycle, including creating exams, selecting items from the question bank, configuring question types, setting time limits and deadlines, and managing assessment results. The interface also supports manual scoring for essay questions, verification of automatic scoring, and examination result analysis.

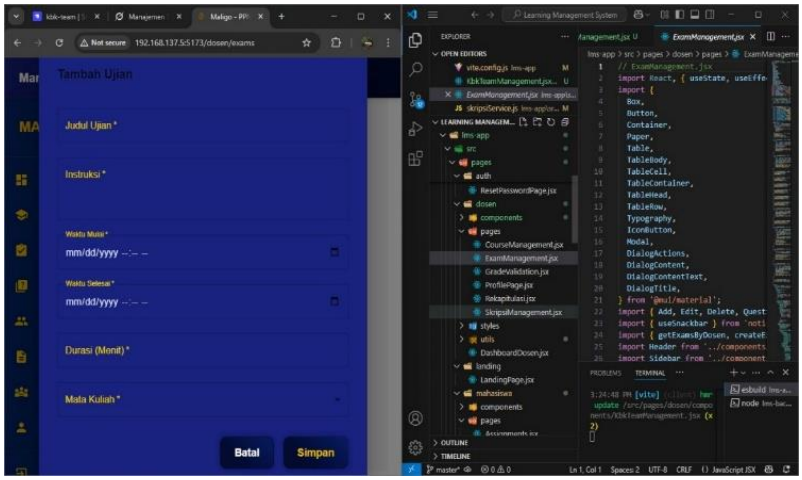


Figure 8. Examination Feature

On the student side, Figure 9 presents the student examination interface, which was designed to provide a more intuitive and focused experience during examination activities. This interface enables students to access and complete examinations in an organized digital environment. These results demonstrate that the system was successfully developed not only as a learning platform but also as an integrated assessment environment.

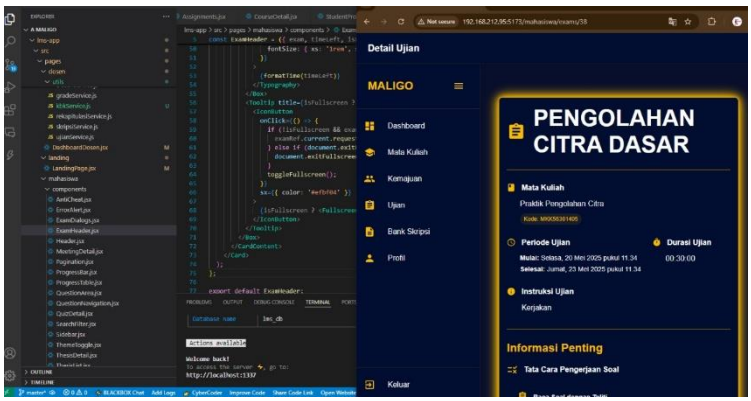


Figure 9. Student Examination Interface

3.2.1 Testing and Evaluation Results

3.2.1.1 Testing Stage

The system was tested using Agile testing, with a focus on evaluating the design from the user perspective. The aim of this stage was to ensure that the system was easy to use, efficient, and satisfactory for administrators, lecturers, and students. The testing process emphasized usability and black-box testing [15].

3.2.1.2 Deployment Stage

After testing, the application was implemented for use in the Computer Engineering Technology Study Program. Initially, the system was run locally and operated smoothly without major obstacles. This stage was followed by further product evaluation, particularly in terms of validity and effectiveness.

3.2.1.3 Validity Results

Validity was assessed using Aiken's V based on expert judgment. As presented in Table 1, the validity scores across the ten assessed aspects ranged from 0.60 to 0.85, with an overall average of 0.73. Most aspects obtained values above 0.70, indicating acceptable content validity. However, several aspects related to notifications and examination supervision only reached 0.60, indicating that these aspects still required revision. Overall, the findings show that the examination feature of MALIGO had adequate content validity.

Table 1. Validity Test Results

Aspect	V Score
Aspect 1	0.80
Aspect 2	0.75
Aspect 3	0.75
Aspect 4	0.60
Aspect 5	0.60
Aspect 6	0.80
Aspect 7	0.80
Aspect 8	0.75
Aspect 9	0.60
Aspect 10	0.85
Average V	**0.73**

3.2.1.4 Effectiveness Results

Effectiveness was tested on 26 students using the G-Score. As shown in Table 2, the G-Score values ranged from 0.23 to 0.39, with an overall average of 0.30. Based on the

criteria used in the manuscript, this value falls into the moderately effective category. These results indicate that the MALIGO examination feature demonstrated a sufficient level of effectiveness, although the gain remained in the moderate range.

Table 2. Effectiveness Test Results

No.	Respondent	G-Score
1	R1	0.28
2	R2	0.31
3	R3	0.36
4	R4	0.25
5	R5	0.32
6	R6	0.39
7	R7	0.24
8	R8	0.31
9	R9	0.38
10	R10	0.32
11	R11	0.24
12	R12	0.33
13	R13	0.25
14	R14	0.26
15	R15	0.26
16	R16	0.29
17	R17	0.23
18	R18	0.32
19	R19	0.35
20	R20	0.31
21	R21	0.37
22	R22	0.24
23	R23	0.26
24	R24	0.35
25	R25	0.38
26	R26	0.27
Average		**0.30**

3.2.1 Review and Launching Results

At the review stage, user feedback indicated that MALIGO had strong potential to be further developed into a more comprehensive academic digital platform. The main recommendations focused on exam security and integrity, including time limits per item, data encryption, application locking during exams, penalties for cheating, screenshot prevention, and stronger supervision mechanisms. Additional suggestions concerned interface cleanliness, responsiveness, intuitive navigation, and the inclusion of new features such as automated remedial systems, complaint features, file downloads, collaborative discussions, SIAKAD integration, examination practice features, and mobile access. These findings indicate that MALIGO was considered promising, although it still requires further refinement to become more secure, efficient, and user-friendly.

3.2. Discussion

This study successfully developed the MALIGO Learning Management System as a more flexible, interactive, and accessible platform for the D4 Computer Engineering Technology Study Program at Politeknik Pertanian Negeri Payakumbuh.

The findings indicate that MALIGO responded to the limitations of conventional LMS platforms that are too broad and insufficiently specific to accommodate program-level instructional needs, particularly under WFH/WFA conditions. In addition, the system achieved an average **Aiken's V score of 0.73**, indicating acceptable validity, and an average **G-Score of 0.30**, indicating moderate effectiveness. These results suggest that the developed system was relevant in content and function, although further refinement is still required.

The validity and moderate effectiveness of MALIGO can be interpreted as evidence that a program-specific LMS may provide a more targeted response to instructional and assessment needs than a general institutional platform. The examination feature, in particular, appears to strengthen the instructional value of the system because it supports the full online assessment cycle, including exam creation, timing, scoring, feedback, and result analysis. This finding is consistent with prior research showing that LMS-based environments become more educationally meaningful when their features are aligned with user needs, system usability, and instructional goals [1], [4], [16], [17]. Research on multimedia and digital learning environments also suggests that coherent digital design supports learner engagement and improves the usability of educational systems [18], [19].

The findings also support previous work indicating that Agile development is effective in producing responsive systems because it allows iterative refinement based on feedback and evolving needs [8]–[10]. In the present study, Agile enabled MALIGO to be developed through sequential stages of planning, design, development, testing, deployment, review, and launch, while remaining open to revision from administrators, lecturers, and students. In this sense, the study extends prior discussions of Agile by demonstrating its relevance not only in general software projects but also in the development of a **web-based examination feature** within a higher education LMS. This also aligns with broader evidence that digital learning systems are more successful when they are shaped by user-centered requirements and evaluated from multiple stakeholder perspectives [17], [20].

From a scholarly perspective, the study contributes to the literature on program-specific LMS development by showing that digital learning systems can be made more relevant when they are designed around the operational and pedagogical needs of a particular study program. From a practical perspective, MALIGO provides lecturers and students with an integrated platform that supports course management, digital assessment, and academic interaction in a more structured way. These findings imply that a specialized LMS may serve as a viable institutional alternative when generic platforms do not sufficiently address disciplinary or contextual needs.

Despite these contributions, several limitations were identified. Some validity items related to notifications and examination supervision still obtained relatively low scores, indicating that these aspects require revision. User feedback also emphasized the need for stronger security and examination integrity mechanisms, including item-level time settings, data encryption, application locking, screenshot prevention, and stronger supervision tools. In addition, interface consistency, usability refinement, and mobile accessibility remain important areas for improvement. These limitations are consistent with broader concerns in the literature that the success of digital learning systems depends not only on platform functionality but also on security, accessibility, and user experience [17], [19].

Future development should therefore focus on three major areas: security and examination integrity, user experience and accessibility, and feature integration and

scalability. Further work on these aspects would strengthen MALIGO as a more effective, efficient, secure, and user-friendly academic platform.

4. Conclusion

This study achieved its objective by developing the MALIGO Learning Management System using an Agile methodology to support online learning in Politeknik Pertanian Negeri Payakumbuh. The findings indicate that the developed system was able to provide a more interactive and functionally relevant digital learning environment, supported by key features such as material management, online examinations, question banks, discussion forums, and user management. The results also show that the measurement instrument had acceptable validity and that user testing indicated a reasonably effective level of system performance.

The main contribution of this study lies in the development of a program-oriented LMS that responds to specific academic needs more directly than a general institutional platform. In practical and pedagogical terms, MALIGO offers an alternative digital learning system that can support online instructional management and academic interaction more effectively. Methodologically, the study also demonstrates the usefulness of Agile development for producing an LMS that is responsive to user needs and iterative refinement.

Nevertheless, several aspects still require improvement, particularly data security, a more user-friendly interface, and the addition of features such as mobile application support and real-time collaboration. These areas provide direction for future system enhancement and further research. Overall, the study shows that an Agile-based LMS can serve as a relevant foundation for more adaptive and context-sensitive digital learning environments in higher education.

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Declarations

Author Contribution Statement

Shuci Putri Amada contributed to the conceptualization of the study, system development, data collection, data analysis, preparation of the original manuscript draft, and manuscript revision. Agus Nur Khomarudin contributed to the conceptualization of the study, methodology design, research supervision, validation of the research findings, data interpretation, critical revision of the manuscript, and final approval of the manuscript. Trinovita Zuhara Jingga contributed to system validation, analysis of the testing results, and manuscript review and editing. Rina Novita contributed to the validation process, evaluation of the research results, manuscript review, and final approval of the manuscript. All authors have read and approved the final version of the manuscript.

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Data Availability Statement

The data generated and analyzed during this study are available from the corresponding author upon reasonable request. Some data are not publicly available due to institutional confidentiality and are used solely for research purposes.

Declaration of Interests Statement

The authors declare that they have no known competing financial or non-financial interests that could have appeared to influence the work reported in this manuscript.

AI Use Statement

During the preparation of this manuscript, the authors used ChatGPT (OpenAI, GPT-5.5) to assist with the initial drafting, manuscript structuring, language editing, and improvement of clarity and readability. All AI-assisted outputs were carefully reviewed, revised where necessary, and verified against the research data and cited references. The authors take full responsibility for the accuracy, originality, integrity, and final content of the manuscript.

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List the ORCID iD for each author (if available) using the full URL format. ORCID ensures unambiguous author identification and accurate attribution of scholarly work.

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