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Development and Feasibility Testing of a Desktop-Based Learning Management System (LMS) Application Using the ADDIE Model

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ABSTRACT

Web-based Learning Management System (LMS) platforms face persistent limitations in Indonesia, particularly complete dependence on internet connectivity, which disrupts learning continuity for students in areas with inadequate digital infrastructure. This study aimed to develop and test the feasibility of a desktop-based LMS application, named EduDesk LMS, using the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. The application was built using the Tauri framework with Rust as the backend and React for the frontend, integrated with Supabase as the cloud database and authentication service. A key feature was an offline-online dual-mode mechanism, which allowed data to be stored locally when connectivity was unavailable and synchronized to the cloud automatically upon reconnection. The research subjects consisted of two educational technology experts for validation and 50 students selected through purposive sampling for the user trial. Data were collected using a Likert-scale questionnaire covering five assessment aspects: Display and Design, Ease of Use, Offline Feature, Usefulness, and User Satisfaction. Results showed that EduDesk LMS achieved a grand mean of 4.00, placing it in the Feasible category (3.41–4.20) across all five dimensions. The Display and Design aspect obtained the highest mean (4.09), followed by Usefulness (4.04), Ease of Use (4.03), User Satisfaction (3.94), and the Offline Feature (3.90). All aspects exceeded the minimum feasibility threshold of 3.41. These findings demonstrated that the ADDIE model effectively guided the development of a systematic, user-centered desktop LMS, and that EduDesk LMS constitutes a feasible platform for supporting flexible learning in higher education environments with varying connectivity conditions.

Keywords: ADDIE Model; Desktop-Based LMS; Educational Technology; Feasibility Testing; Learning Management System

1. INTRODUCTION

The development of information and communication technology has brought fundamental transformation to the world of education. The integration of technology into the learning process is no longer merely an option but an urgent necessity in this digital era. Various digital platforms and devices have been developed to support the effectiveness of learning, ranging from interactive multimedia content to comprehensive learning management systems. One of the most significant educational technology innovations is the Learning Management System (LMS), a digital platform designed to plan, deliver, and evaluate the learning process in an integrated manner (Balkaya & Akkucuk, 2021; Shurygin et al., 2021). LMS encompasses various essential features such as content delivery, assignment management, quiz administration, discussion forums, and learning progress tracking, enabling learning to take place in a more structured and measurable way.

LMS has proven itself as a vital component in the modern learning ecosystem, particularly in the post-COVID-19 era. Various studies report that LMS use significantly improves student motivation, engagement, and learning outcomes when integrated with well-designed instructional approaches (Furqon et al., 2023).

Popular LMS platforms such as Moodle, Blackboard, Canvas, and Google Classroom have supported synchronous and asynchronous learning, online examinations, collaborative discussions, and adaptive learning analytics (Gamage et al., 2022; Kamath et al., 2025). Furthermore, LMS enables personalized learning through material recommendations and data analytics-based interventions, allowing each learner to study according to their individual needs and pace (Kem, 2022; Pan et al., 2024).

Although the benefits of LMS have been well documented, web-based LMS implementation still faces several critical limitations, particularly in developing countries. Complete dependence on internet connectivity remains the greatest barrier; access to materials, assignment submission, and online examination are all disrupted when the network is unavailable (Badaru & Adu, 2022; Gamage et al., 2022). Students in remote areas or underdeveloped, frontier, and outermost regions (3T regions) frequently encounter difficulties meeting the technical requirements for participating in online learning, even when an LMS has been formally provided by their institution (Furqon et al., 2023). This access gap creates a tangible inequality in learning experiences, where the quality of learning is heavily influenced by internet stability and the devices available to users.

In addition to connectivity issues, web-based LMS also faces limitations in terms of infrastructure and pedagogy. Weak internet connections, limited device availability, and platform instability remain significant obstacles that have yet to be resolved (Mohammadi et al., 2021; Okoye et al., 2023). From a pedagogical perspective, LMS implementation is often limited to uploading text materials and assigning tasks, with very little use of videos, audio, or meaningful interactive activities (Makruf et al., 2022). This phenomenon indicates that the potential of LMS as a rich and interactive learning medium has not been maximized, largely due to infrastructure constraints and low digital literacy among users (Barrot et al., 2021; Nouraey & Al-Badi, 2023).

In response to these issues, the development of desktop-based LMS has become a highly relevant solution, particularly for the Indonesian context, which still has a digital infrastructure gap. Desktop-based or on-premise LMS can operate through a local intranet network and is more tolerant of unstable connectivity conditions, while providing greater data control to institutions (Sanchez et al., 2024; Shurygin et al., 2021). This approach allows the learning process to continue offline, while data synchronization to the cloud is performed when internet connectivity is available. Literature reviews also indicate that several studies have recommended the importance of self-hosted options and partial offline access to address internet infrastructure limitations, particularly in areas with limited connectivity (Badaru & Adu, 2022; Furqon et al., 2023).

Although the need for desktop-based LMS has been identified, a clear research gap remains in the development of a comprehensive, modern desktop LMS application that has been academically tested for feasibility in the Indonesian educational context. Most existing research focuses on web-based LMS development or the use of existing LMS platforms, while the development of desktop LMS using cutting-edge technology such as Tauri that combines offline and online capabilities remains very limited. The development of learning applications, including LMS, using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) has been proven to produce valid and feasible products (Ade Rahayu, 2025; Rahmandhani & Utami, 2022). This model was selected because of its systematic, flexible procedures and its support for continuous revision at each development stage. Based on this background, this study aims to develop and test the feasibility of a desktop-based LMS application using the ADDIE model, resulting in a learning system that can be used effectively in both online and offline conditions, to support the equalization of quality education access in Indonesia.

2. RESEARCH METHOD

2.1. TYPE AND MODEL OF RESEARCH

This study is a Research and Development (R&D) study, which is a research method used to produce a specific product and test its effectiveness (Ade Rahayu, 2025). The development model used is ADDIE, which stands for Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model was chosen because it offers a systematic, adaptive framework oriented toward continuous evaluation, making it well-suited for developing complex educational technology products such as LMS (Rahmandhani & Utami, 2022). Compared to other development models, ADDIE has advantages in ease of adaptation, support for

iterative revision at each phase, and suitability for various levels and educational contexts (Gamal, 2022). This approach ensures that every design and development decision is based on systematic needs analysis and structured user feedback.

2.2. RESEARCH PROCEDURE

2.2.1. Analysis

The analysis phase is the foundation of the entire development process. At this stage, user needs identification was conducted covering three main user groups, namely students, instructors, and administrators. Needs analysis was carried out through literature review, field observation, and informal interviews with prospective users. The results showed that educational institutions require an LMS system that can operate under unstable internet connectivity conditions, supporting integrated management of classes, learning materials, assignments, and quizzes. Technology infrastructure analysis was also conducted to determine technical specifications appropriate to actual field conditions.

2.2.2. Design

The design phase encompassed the design of the system architecture, user flow, interface, and database structure. The system design referenced four main artifacts developed systematically to map the functional and non-functional requirements of the application, namely: (1) use case diagram to map user roles and access rights, (2) activity diagram to illustrate the assignment submission workflow with an online-offline mechanism, (3) class diagram to define the entity structure and data relationships, and (4) system architecture to describe the integration between the desktop and cloud layers.

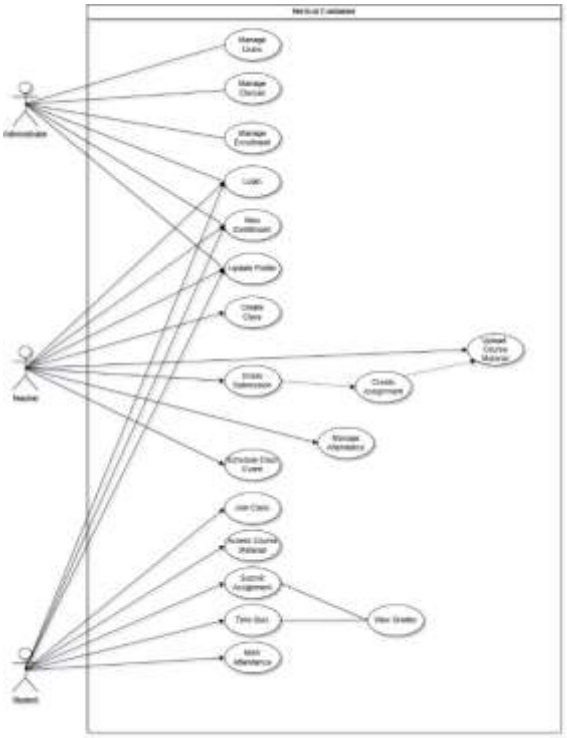

Figure 1. Use Case Diagram of Edudesk LMS

The use case diagram was designed to map interactions between the three main system actors and the available functionalities. The system defines three main actors: Instructor, Student, and Admin, each with distinct access rights and functionalities as illustrated in Figure 1. Relationships between use cases are depicted using association lines and include relationships indicating functional dependencies.

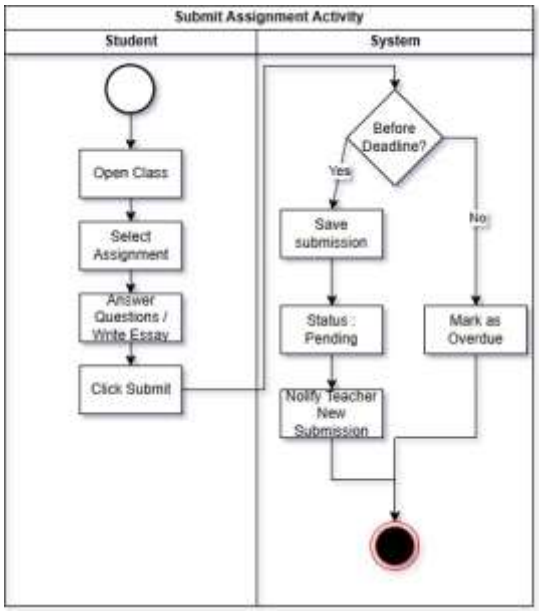

Figure 2. Activity Diagram

The activity diagram was developed to describe the workflow of the assignment submission process, which is one of the core system features. The flow begins with the student opening the assignment, then answering the available questions, and clicking the submit button. The system then checks internet connection availability. If the connection is available, the answer is sent directly to Supabase (cloud database) and the system displays a success notification. Conversely, if internet connectivity is unavailable, the answer is first saved to the device's local storage and the system displays an offline-saved notification. This dual-mode mechanism is a key feature that differentiates the developed application from conventional web-based LMS.

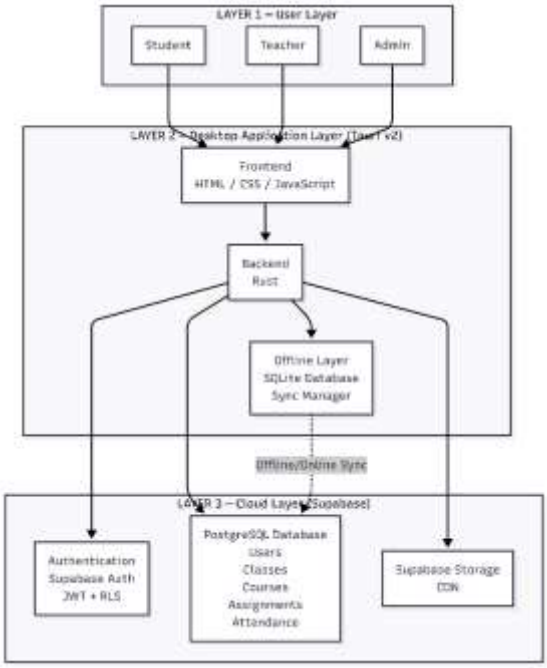

Figure 3. System Architecture of EduDesk LMS

The system architecture was designed using a layered architecture approach consisting of three main layers. The first layer is the User Layer covering three user groups, namely Students, Instructors, and Admins. The second layer is the Tauri-based Desktop Application that integrates Frontend (React/Vue/HTML) and

Backend (Rust) connected through an HTTP Client. The third layer is the Cloud Layer using Supabase as the cloud service provider, encompassing Authentication for user authentication management, PostgreSQL Database for structured data storage, and Storage for managing learning material files. This architecture enables the application to function independently on the desktop side while remaining connected to cloud services when internet connectivity is available.

The database structure was designed following standard UML class notation, with the classroom entity as the central component connected to class_1 (video content), post_material (file-based materials), and quotation (class access code mechanism), using one-to-many relationships throughout.

2.2.3. Development

The development phase is the realization of all designs created during the design phase. The LMS application was developed using the Tauri framework, a modern cross-platform framework that utilizes web technology for the user interface and Rust for efficient and secure backend logic. The frontend was built using React, enabling the construction of a dynamic and responsive user interface. The cloud database uses Supabase with PostgreSQL as the relational database engine, and Supabase Storage for managing learning material files. The offline feature was developed with a local storage mechanism that allows data to be stored on the user's device and synchronized to the cloud when connectivity is available.

Table 1. Technology and Development Tools for EduDesk LMS Application

No.	Component	Technology/Tools
1.	Frontend Programming Language	JavaScript (React)
2.	Backend Programming Language	Rust
3.	Desktop Application Framework	Tauri
4.	Cloud Database	Supabase (PostgreSQL)
5.	Authentication	Supabase Auth (JWT)
6.	Cloud File Storage	Supabase Storage
7.	Local Storage	SQLite / Local Storage
8.	Target Platform	Windows
9.	UI/UX Design	Figma
10.	Version Control	Git / GitHub

2.2.4. Implementation

The implementation phase involved testing the application under real usage conditions. The application was installed on desktop computers and laptops used by the research subjects. Implementation was carried out in stages, beginning with evaluation by an expert in the field of educational technology to obtain validation and improvement feedback, followed by a trial with all student research subjects. Each implementation stage was accompanied by data collection through questionnaires and observational notes to identify technical and non-technical issues requiring improvement.

2.2.5. Evaluation

The evaluation phase took place formatively at each development phase and summatively at the end of the process. Formative evaluation was conducted based on feedback from experts and users to make necessary revisions. Summative evaluation was conducted through analysis of questionnaire data collected from expert validation and student trials. Evaluation results were used to draw conclusions about the feasibility of the application and provide recommendations for further development (Dewanti et al., 2022; Hasanah Dewi Lestari, 2023).

2.3. RESEARCH SUBJECTS

The research subjects consisted of two groups. The first group consisted of two experts in educational technology and information systems who evaluated the product through a direct demonstration session covering aspects of interface design, ease of use, and feature utility. The second group consisted of 50 students selected using purposive sampling from three classes within the Information and Communication Technology Education study program at Universitas Pendidikan Indonesia, based on two criteria: (1) having access to a computer device, and (2) having prior experience with at least one digital learning platform. The diversity of digital literacy levels was reflected through self-reported LMS usage frequency, ranging from daily users (8%) to those who had never used any LMS platform (6%).

2.4. DATA COLLECTION TECHNIQUE

The data collection technique used in this study was a questionnaire. The questionnaire was used to collect assessment data from the expert (validation) and response data from students (user trial). The use of questionnaires was chosen because they are capable of collecting data from a large number of respondents efficiently, in a standardized manner, and producing quantitative data that can be analyzed using descriptive statistics. The questionnaire was administered to subjects after they used the developed LMS application in a predetermined trial session.

2.5. RESEARCH INSTRUMENT

The research instrument used was a questionnaire with a five-point Likert scale, where a value of 1 represents the category of Strongly Disagree, 2 represents Disagree, 3 represents Somewhat Agree, 4 represents Agree, and 5 represents Strongly Agree. The instrument covers five main assessment aspects as presented in Table 2 below.

Table 2. Instrument Grid for LMS Application Feasibility Assessment

No.	Assessment Aspect	Indicator
1	Display & Design	Visual attractiveness
		Readability of text, icons, and buttons
		Interface design consistency
		Color and layout harmony
2	Ease of Use	Ease of navigation between features
		Speed of independently understanding the application
		System response speed
		Ease of login process
		Naturalness of navigation
3	Offline Feature	Access to materials without internet
		Security of offline data storage
		Clarity of connection status information
		Usefulness of offline feature
4	Usefulness	Support for structured learning
		Ease of accessing materials
		Smooth assignment and quiz submission
		Support for independent learning
		Meeting learning platform needs
5	User Satisfaction	Overall satisfaction
		Interest in continued use
		Willingness to recommend
		Feasibility as a learning platform

2.6. DATA ANALYSIS TECHNIQUE

The collected data were analyzed using descriptive quantitative analysis techniques. The mean score of each statement item was calculated, then averaged overall to obtain the final score. The mean score was then categorized using the feasibility conversion scale as presented in Table 3 below.

Table 3. Conversion of Mean Score to Feasibility Category

No.	Score Range	Feasibility Category
1	4.21 - 5.00	Very Feasible
2	3.41 - 4.20	Feasible
3	2.61 - 3.40	Moderately Feasible
4	1.81 - 2.60	Less Feasible
5	1.00 - 1.80	Not Feasible

The application is declared feasible if it obtains a minimum mean score of 3.41, or falls within the Feasible category or above across all assessment aspects.

3. RESULTS AND DISCUSSION

3.1. PRODUCT DEVELOPMENT RESULTS

The final development result is a desktop-based LMS application named EduDesk LMS, built on the Tauri framework with Supabase cloud service integration. The application is designed to serve three main user groups with different access rights and functionalities, namely students, instructors, and administrators. The system provides an intuitive and responsive interface that can be operated on Windows, macOS, or Linux-based computers without requiring additional dependency installation.

Based on the use case diagram designed during the design phase, the developed LMS application provides comprehensive functional features to support the learning process. A detailed breakdown of system features by user role is presented in Table 4 below.

Table 4. EduDesk LMS System Features by User Role

No.	Feature	Function Description	Actor
1	Login & Registration	JWT-based user authentication via Supabase Auth	All actors
2	Dashboard	Main page displaying a summary of classes, assignments, and recent activities	All actors
3	Class Management	Create, edit, and delete classes; assign instructors and participants	Instructor, Admin
4	Material Management	Upload, download, and delete materials in PDF, document, and other formats	Instructor
5	Learning Videos	Add and manage videos per session (meeting_number)	Instructor
6	Assignment & Quiz Management	Create, distribute, and manage assignments and session-based quizzes	Instructor
7	Complete Assignments/Quizzes	Answer questions and submit assignments with automatic online/offline mechanism	Student
8	View Materials & Classes	Access all materials and list of enrolled classes	Student
9	Class Access Code (Quotation)	Join a class using a unique code provided by the instructor	Student
10	Offline-Online Synchronization	Save data locally when offline and synchronize to Supabase when connection is available	All actors
11	User Management	Manage user accounts and access rights across the system	Admin

A key advantage of EduDesk LMS is its dual-mode submission mechanism: data is sent directly to Supabase when online, and stored locally when offline, with automatic synchronization upon reconnection. This ensures learning continuity regardless of connectivity conditions.

The database structure follows the class diagram design, with the classroom entity as the central component connecting video content, file-based materials, and class access codes. The entire structure is implemented using PostgreSQL via Supabase, which also handles authentication and file storage.

3.2. EXPERT EVALUATION RESULTS

Expert validation was conducted by two validators in the fields of educational technology and information systems. Both validators evaluated the developed product through a direct demonstration session, independently operating all main features of the EduDesk LMS application and subsequently providing structured written assessments covering aspects of interface design, ease of use, feature utility, and general technical feasibility.

The expert evaluation results are presented in Table 5 below.

Table 5. Expert Evaluation Results of the EduDesk LMS Prototype

No.	Aspect	Expert Assessment	Notes / Feedback	Revision Follow-up
1	Display (Visual Design)	Layout is clean and reasonably tidy. The color scheme is comfortable for extended use.	Icon sizes and styles are inconsistent across pages. Caption font is too small on low-resolution screens.	Icons were standardized in size and style. Font size for labels and captions was increased and color contrast was improved.

No.	Aspect	Expert Assessment	Notes / Feedback	Revision Follow-up
2	Ease of Use	Navigation between features is generally understandable. Core features can be operated without special guidance.	Some buttons lack function labels. Menu order does not reflect a natural learning workflow.	Tooltips were added to all main buttons. Menu order was reorganized to follow the flow: class, material, assignment, quiz.
3	Offline Feature (Dual-Mode)	The offline-online dual-mode concept is considered innovative and relevant for contexts with limited internet infrastructure.	The connection status indicator needs to be more visible so users always know the synchronization status.	The connection status indicator was moved to a more prominent position at the top of the interface.
4	Quiz and Assignment Features	The assignment submission feature is working well. The quiz workflow is not yet fully explicit for novice users.	The quiz completion flow from opening questions to submitting answers is considered unclear.	A step indicator was added to the quiz interface so users can monitor their completion progress.
5	General Utility	Overall, the product has high utility as a desktop-based learning platform consistent with real field needs.	No onboarding guide is available for first-time users.	A welcome screen with a brief usage guide was added, appearing the first time the application is opened.

Based on Table 5, the expert provided positive assessments of the concept and technical implementation of EduDesk LMS overall, with special appreciation for the offline-online dual-mode feature, which was considered innovative and relevant to the Indonesian educational context. The mean score from expert validation reached 4.92 out of 5.00, placing the application in the Very Feasible category. All validator feedback was subsequently addressed through prototype revision before the product was trialed with students. After revisions were completed, the validator confirmed that the prototype was adequate and ready to be trialed with the student group as end users.

3.3. STUDENT INITIAL IMPRESSION RESULTS

The product trial was conducted with 50 students selected using purposive sampling. The majority of respondents were second-semester students (80%), followed by sixth-semester (12%) and fourth-semester students (8%). In terms of devices used, 78% of respondents used a personal laptop or computer, 16% used a friend's computer, and 6% used a campus laboratory computer. A total of 48% of respondents tried the application for 10 to 20 minutes, and 42% for less than 10 minutes before completing the questionnaire. In terms of prior LMS usage experience, 40% of respondents rarely used LMS, 24% used it several times per week, 22% several times per month, 8% every day, and 6% had never used any LMS platform. Given the brief trial duration and the campus Wi-Fi environment, the collected data primarily reflects students' initial impressions of the application rather than comprehensive long-term usability assessments.

Assessment data were collected using a Likert scale questionnaire (1–5) covering 22 statement items across five assessment aspects. The results of descriptive analysis per assessment aspect are presented in Table 6 below**.**

Table 6. Student Initial Impression Results for EduDesk LMS Application (n = 50)

No.	Assessment Aspect	Mean	SD	Category
1	Display & Design	4.09	0.76	Feasible
2	Ease of Use	4.03	0.79	Feasible
3	Offline Feature (Dual-Mode)	3.90	0.88	Feasible
4	Usefulness	4.04	0.75	Feasible
5	User Satisfaction	3.94	0.85	Feasible
Grand Mean (22 Items)		4.00	**0.80**	Feasible

Based on Table 6, the Display and Design aspect obtained the highest mean of 4.09, followed by the Usefulness aspect with a mean of 4.04, the Ease of Use aspect with 4.03, User Satisfaction with 3.94, and the Offline Feature aspect with 3.90. Overall, the grand mean of the 22 instrument items reached 4.00. Referring to the feasibility conversion scale in Table 3, this score falls within the range of 3.41–4.20, placing it in the Feasible category. No single assessment aspect fell below the minimum feasibility threshold (3.41), indicating that all assessment dimensions met the established criteria based on initial impressions. It should be noted that the Offline Feature score (3.90) was obtained in a campus environment with stable Wi-Fi access; a more

rigorous evaluation of this feature would require testing under real offline conditions, which is recommended for future research.

3.4. DISCUSSION

The results of developing the EduDesk LMS desktop-based application using the ADDIE model demonstrate that the resulting product has met the feasibility criteria as assessed by both an expert validator and student end users. A grand mean of 4.00 across 22 instrument items places EduDesk LMS firmly within the Feasible category (3.41–4.20), confirming that the application is ready to be implemented as a supporting learning platform in higher education settings. More broadly, this finding provides empirical evidence that the development of a desktop-based, offline-capable LMS represents a viable and relevant technological response to the persistent digital infrastructure inequalities that continue to characterize the Indonesian educational landscape (Badaru & Adu, 2022; Furqon et al., 2023). The comprehensive nature of this feasibility outcome, spanning design quality, usability, offline functionality, utility, and user satisfaction, indicates that EduDesk LMS succeeds not only as a technical artifact but as a pedagogically purposeful platform aligned with real learner needs.

The Display and Design aspect obtained the highest mean score of 4.09, indicating that the visual interface of EduDesk LMS was well received by users. This finding is consistent with the established understanding that good interface design constitutes a critical determinant of technology acceptance, particularly among first-time or infrequent LMS users (Balkaya & Akkucuk, 2021). An intuitive, visually consistent, and aesthetically appealing interface enables users to interact with the system confidently and efficiently without requiring intensive pre-use training (Balkaya & Akkucuk, 2021). This is particularly significant in the context of EduDesk LMS, given that 40% of trial respondents reported rarely or never using any LMS platform prior to the study. For this population, the quality of the visual interface constitutes the first and most immediate point of interaction with the system, making a positive initial user experience a prerequisite for sustained engagement. The design improvements implemented following expert feedback, including icon standardization, improved font sizing, and enhanced color contrast, directly contributed to the favorable display scores. This iterative design refinement process reflects the structured responsiveness embedded in the ADDIE model, wherein design decisions are continuously informed by stakeholder feedback rather than fixed at the outset (Rahmandhani & Utami, 2022). The high display score also implies that learners perceive EduDesk LMS as a credible and professional platform, a perception that has been linked to stronger motivation and continued usage intention in LMS adoption studies (Shurygin et al., 2021).

The Ease of Use aspect obtained a mean of 4.03, indicating that the majority of students were able to navigate and operate the core features of EduDesk LMS independently and with reasonable efficiency. This positive result confirms that the interface design and feature architecture successfully lowered the barrier to entry for new users, which is especially critical in educational technology contexts where learners often lack specialized technical training (Makruf et al., 2022). The structured navigation flow that was revised after expert feedback reorganized to follow the natural learning workflow of class, material, assignment, and quiz appears to have meaningfully contributed to this ease of use score. However, the relatively lower score on the system response speed indicator deserves targeted attention in the next development iteration. Some respondents accessed the application using shared or laboratory computers with heterogeneous hardware specifications, which may have introduced variability in perceived system responsiveness. This observation aligns with Gamage et al., (2022), who emphasize that the technical performance of a learning platform, including load speed and system responsiveness, directly shapes the quality of the user learning experience. Platform instability and slow response times have been identified as recurring obstacles to effective LMS use, particularly when device availability and hardware quality are inconsistent across learners (Mohammadi et al., 2021; Okoye et al., 2023). These performance considerations underscore the importance of ongoing application optimization, particularly for a desktop-based system intended to serve users across diverse hardware environments.

The Usefulness aspect obtained a mean of 4.04, confirming the functional relevance and pedagogical value of a desktop-based LMS in the Indonesian higher education context. Students across all levels of prior LMS experience rated EduDesk LMS as supporting structured learning, facilitating material access, enabling smooth assignment and quiz submission, and meeting their overall needs as a learning platform. This finding is consistent with the broader evidence base demonstrating that LMS use positively impacts academic

performance and learner engagement when properly designed and aligned with real user needs (Furqon et al., 2023). The offline-capable dual-mode mechanism, which allows assignment submission and data storage to occur locally when connectivity is unavailable, with automatic cloud synchronization when the connection is restored, was specifically validated by the expert as innovative and highly relevant to the Indonesian educational context (Sanchez et al., 2024). This mechanism directly addresses one of the most persistent and well-documented barriers to effective LMS use in Indonesia: complete dependence on internet connectivity, which continues to disrupt learning for students in areas with unstable or absent network infrastructure (Badaru & Adu, 2022; Mohammadi et al., 2021). The Offline Feature aspect scored 3.90, the lowest among all dimensions but still comfortably within the Feasible category. This relatively modest score, compared to the other aspects, may reflect the fact that most students conducted the trial in a campus environment with available Wi-Fi, meaning the offline mechanism was not fully activated or experienced during the brief assessment session. A more accurate evaluation of the offline feature would require deployment in real-world settings with genuine connectivity constraints, which represents an important direction for future research. The systematic application of the ADDIE model throughout the development process proved effective in producing a structured, user-centered, and iteratively refined product. Each phase of ADDIE, from in-depth needs analysis and systematic design of system architecture and user flows, through development using cutting-edge Tauri and Supabase technology, staged implementation, to formative and summative evaluation, provided a robust quality assurance framework (Ade Rahayu, 2025; Rahmandhani & Utami, 2022). Crucially, ADDIE's iterative revision mechanism ensured that expert validator feedback was not merely collected but systematically acted upon before student trials commenced, producing a product that was demonstrably improved across all five dimensions. These findings reinforce the position of ADDIE as a reliable and adaptive framework for developing complex educational technology products in the Indonesian context, as has been demonstrated across a range of development studies encompassing multimedia, instructional applications, and teaching materials (Gamal, 2022; Hasanah Dewi Lestari, 2023). Compared to more linear development models, ADDIE's built-in support for revision at each phase is especially well-suited to complex software systems like LMS, where usability, pedagogy, and technical performance interact in ways that cannot be fully anticipated at the design stage (Rahmandhani & Utami, 2022).

Taken together, the results of this study constitute meaningful evidence that a desktop-based, offline-capable LMS developed using the ADDIE model can achieve multi-dimensional feasibility as assessed by both an expert validator and student end users in a higher education setting. EduDesk LMS addresses a clearly identified gap in the literature: the absence of a comprehensively tested, academically validated, modern desktop LMS application designed for the Indonesian educational context (Sanchez et al., 2024; Shurygin et al., 2021). The majority of prior LMS research in Indonesia and comparable developing country contexts has focused either on the adoption and critique of existing web-based platforms such as Moodle or Google Classroom, or on the identification of connectivity barriers without proposing technically realized solutions (Barrot et al., 2021; Furqon et al., 2023). EduDesk LMS moves beyond diagnosis to implementation, demonstrating that a locally developed, infrastructure-adaptive platform can achieve user-assessed feasibility within a single development cycle when guided by a systematic framework such as ADDIE. The application's hybrid architecture combining the stability and offline capability of a desktop application built on Tauri with the scalability and real-time synchronization of a cloud backend provided by Supabase, represents a technically novel response to the hybrid connectivity reality faced by Indonesian higher education institutions. This architecture aligns with the growing body of literature recommending self-hosted or partial offline LMS options as a pragmatic solution to internet infrastructure limitations (Badaru & Adu, 2022; Sanchez et al., 2024). Nevertheless, this study has several important limitations that must be acknowledged. First, the trial was conducted over a brief session of 10 to 20 minutes for most respondents, which limits the depth and reliability of usability and satisfaction assessments. Second, the research sample was drawn from a single institution, which restricts the generalizability of the feasibility conclusions. Third, expert validation was conducted by two validators from the same institution, which may limit the diversity of evaluative perspectives; future studies should engage validators from multiple institutions and disciplinary backgrounds. Fourth, the current study does not assess learning effectiveness: a positive feasibility rating indicates that students find the platform usable and relevant, but does not demonstrate whether use of EduDesk LMS produces measurable improvements in academic outcomes. Future research should address these limitations through longitudinal effectiveness studies using experimental or quasi-experimental designs, expanded multi-institution trials encompassing diverse geographic and demographic contexts including 3T regions, and multi-expert validation panels covering pedagogical design, information systems, and user experience dimensions.

4. CONCLUTION

This development research produced a desktop-based Learning Management System application named EduDesk LMS, developed using the ADDIE model with the Tauri framework and Supabase cloud services. Based on the research results, it can be concluded that: First, the development of EduDesk LMS using the ADDIE model produced a systematic and structured product, encompassing a class management system, materials, assignments, quizzes, and an innovative offline-online data synchronization mechanism. Second, the results of trials with 50 students showed a grand mean of 4.00 in the Feasible category, with the Display aspect obtaining a mean of 4.09 (Feasible), Ease of Use 4.03 (Feasible), Offline Feature 3.90 (Feasible), Usefulness 4.04 (Feasible), and User Satisfaction 3.94 (Feasible). Third, all assessment aspects were above the minimum feasibility threshold (3.41), so EduDesk LMS is declared feasible for use as a desktop-based learning platform that can operate in both online and offline conditions.

The implication of this research is that a desktop-based LMS is a relevant and potential solution for addressing internet connectivity challenges in Indonesia, particularly in areas with suboptimal digital infrastructure. Educational institutions may consider adopting a hybrid approach (desktop + cloud) in developing or selecting their LMS platforms. For future research, it is recommended to: (1) conduct learning effectiveness testing using EduDesk LMS with a more rigorous experimental design; (2) expand the subject scope to various educational levels and more diverse geographic regions; and (3) develop advanced features such as adaptive learning analytics and integration with other digital platforms to maximize the potential of EduDesk LMS as a comprehensive learning ecosystem.

DECLARATION OF GENERATIVE AI USE

The authors used Claude (Anthropic) as an AI-assisted writing tool to support language editing, grammatical refinement, and improving the structural clarity of the manuscript. All research concepts, research design, data collection, data analysis, interpretation of results, and conclusions were independently developed, conducted, and verified by the authors. All AI-assisted content has been reviewed, verified, and revised by the authors to ensure accuracy, originality, and alignment with scholarly standards. The authors take full responsibility for the integrity and reliability of this work.

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