







Design and Implementation of an Online Thesis Management System Using the Waterfall Model at a Health Polytechnic in Indonesia

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Abstract

The study aims to develop and validate an online thesis management system designed to address the limitations of manual systems in the thesis supervision process, such as a lack of transparency, delays in communication, and difficulties in monitoring student progress. In response to these challenges, this study proposes an integrated system framework that facilitates real-time academic interaction between students and their thesis advisors. The method employs a system development research approach using the waterfall model, which was selected for its suitability in developing structured and systematically documented systems. The research phases include requirements analysis, system design based on Entity Relationship Diagrams (ERDs) and use case diagrams, implementation, and system testing. The system was evaluated using a usability testing approach, involving the distribution of a questionnaire to 55 respondents to measure usability, ease of use, and user satisfaction. The results indicate that the developed system model is capable of improving the efficiency of thesis supervision management, enhancing the transparency of academic processes, and supporting data driven decision making. The main contribution of this study lies in the development of an adaptive, user-oriented academic information system model, which not only has practical implications for the management of final projects but also provides a conceptual foundation for the development of similar systems in higher education institutions. The implications of this study underscore the importance of ongoing system integration with other academic platforms, as well as the need for periodic system evaluations to enhance the user experience and ensure the sustainability of the implementation.

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INTRODUCTION

The rapid advancement of information technology has driven significant transformation across various sectors, including higher education. Digitalization has not only transformed the learning process but also academic administration systems, including the management of student theses. Higher education institutions in various countries, including Indonesia, have begun adopting online-based systems to improve the efficiency, accessibility, and transparency of academic services (Ausat, 2023; Zuhairi et al., 2020). This transformation has become increasingly relevant in the wake of the COVID-19 pandemic, which has accelerated the need for integrated and adaptive academic systems.

The thesis supervision process still faces various structural and technical challenges. The thesis writing process involves complex stages that require intensive coordination between students and their advisors, from the proposal stage through to the final defense. In practice, limited meeting time, scheduling difficulties, and the lack of a system capable of systematically documenting progress often lead to delays in completing studies and low-quality academic interactions (Vos & Kamei, 2024). Furthermore, systems that remain fragmented and unintegrated undermine the effectiveness of thesis management.

A number of previous studies have examined the development of online-based thesis management systems. However, most of these studies have focused primarily on the technical aspects of system implementation, such as document management or task tracking (Setiyani et al., 2020; Faiz et al., 2024), without incorporating a user-centered design approach. Furthermore, existing research tends not to provide a comprehensive conceptual framework for managing academic interactions holistically, including

aspects of communication, progress monitoring, and evaluation of mentoring performance (Hunt et al., 2022). Another limitation is the lack of a systematic user experience-based evaluation approach, meaning the effectiveness of the developed system has not yet been comprehensively measured (Hariyanto, 2022). Thus, there is a clear research gap: the absence of a thesis information system model that integrates a user-centered approach, comprehensive academic management features, and user experience-based evaluation within a single, cohesive framework. Furthermore, the context of implementation at health institutions such as Politeknik Kesehatan (Poltekkes) has rarely been studied, despite their specific academic needs.

Given this gap, this study offers an innovative solution in the form of an online thesis management system that not only integrates various administrative functions but is also designed using a user-centered approach to enhance the quality of interaction between students and their academic advisors.

This system is equipped with features for activity planning, real-time progress reporting, and an evaluation mechanism based on usability testing to ensure alignment with user needs. Thus, the contribution of this research is not only technical but also conceptual, in the form of a more adaptive and measurable framework for managing thesis supervision.

The objectives of this study are to (1) develop an integrated, user-oriented online system for final-year projects, (2) implement the system in the context of higher education in health sciences, and (3) evaluate the system's effectiveness based on usability, ease of use, and user satisfaction. The findings of this study can provide practical insights for higher education institutions in improving the quality of academic services, as well as theoretical insights for the development of a

sustainable educational information system model.

METHOD

Research Design and Approach

This study employs a Design Science Research (DSR) approach aimed at developing and evaluating an artifact in the form of an online-based final project information system. The DSR approach was chosen because it is relevant for generating innovative solutions to practical problems while also providing scientific contributions in the form of system models and conceptual frameworks. The DSR phases in this study include: (1) problem identification, (2) formulation of solution objectives, (3) artifact design and development, (4) demonstration, and (5) evaluation. This study also adopts a quantitative approach in the system evaluation phase to objectively measure usability and user satisfaction.

Research Site and Period

The study was conducted at the Padang Public Health Polytechnic (Poltekkes Kemenkes Padang), Indonesia, from June to December 2024. This location was chosen because it still uses a thesis supervision system that has not yet been fully integrated, making it a relevant context for the system's implementation.

System Development Method

System development is carried out using the waterfall model, which was chosen because it provides a systematic and structured approach to software development, particularly for systems with relatively stable requirements. The phases of this model include: (1) requirements analysis & definition; (2) system & software design; (3) implementation & unit testing; (4) System Integration & testing; and (5) Operation & maintenance

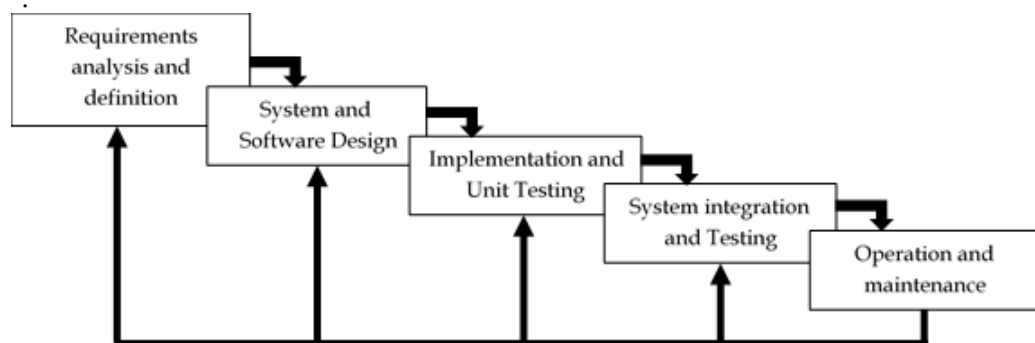


Figure 1. Waterfall Model

The waterfall model takes basic process activities and represents them as various process phases such as requirements analysis and definition, software design, implementation, unit testing, system integration, system testing, operation and maintenance. The stages of the waterfall model can be seen in the figure below.

In software system development, there are several stages that must be completed to ensure the final product meets user needs and functions properly (see Figure 1). This process begins with requirements analysis and definition, where the development team identifies and gathers all the necessary requirements for the system to be designed. At this stage, it is important to collaborate with

system users and IT professionals to understand the system's characteristics, limitations, and objectives. This process aims to ensure that all expected system functions are met.

After the analysis phase is complete, the next step is system and software design. Here, the system architecture is developed based on the previously identified requirements. This design includes a description of the basic abstractions and relationships between system components. The goal of this phase is to provide a clear picture of how the system will function and interact. Once the design is complete, the process moves on to the coding phase. At this stage, the design is translated into a

programming language that can be understood by the computer. This process involves writing code that conforms to predetermined specifications so that the system can operate correctly. After the code is written, the next phase is program testing, which includes integration and system testing. At this stage, the primary focus is on the system's logic and functionality. Every part of the system is tested to minimize errors and ensure the product design meets expectations. This testing is crucial for ensuring the quality and reliability of the software before it is released to users.

The final stage in the system development process is program implementation and maintenance. Once the software is complete and has undergone rigorous testing, the system is launched for use. However, the process doesn't stop there; system maintenance is also performed to address any errors that may be discovered after launch. Furthermore, during this stage, developers can undertake further development, such as adding new features or functions to improve performance and user experience. Overall, the stages in software system development are a structured and systematic process, aimed at producing a high-quality product that meets user needs. Each stage has its own role and is interconnected, so it's important to go through each step carefully and thoroughly.

Technology and Development Environment

The development of this thesis's Monitoring Information System utilizes a web-based client-server architecture with the Model-View-Controller (MVC) pattern to separate business logic, data presentation, and application control. The system was built using PHP version 8.1 as the server-side programming language responsible for processing business logic and managing communication between the user interface and the database. The CodeIgniter framework version 4.3.5 was chosen as the development framework because it provides a clear MVC structure, comprehensive built-in libraries for validation, security, and session management, and optimal performance for medium-scale applications. This framework allows for more structured, maintainable development, and adheres to best practices in modern web application development.

For the user interface (frontend), the system uses a combination of HTML5 for content structure, CSS3 with the Bootstrap framework version 5.2 for styling and responsive design, and JavaScript with the jQuery library version 3.6 for interactivity and DOM manipulation. Bootstrap was chosen because it provides consistent UI components, a responsive grid system for various screen sizes, and comprehensive documentation. AJAX (Asynchronous JavaScript and XML) is implemented for asynchronous communication between the client and server, enabling data updates without reloading the entire page, thus improving the user experience and responsiveness of the application. All front-end assets are organized in a separate directory structure for easy maintenance and performance optimization.

The database system is designed using MySQL version 8.0 as the Database Management System (DBMS) with the InnoDB storage engine supporting ACID (Atomicity, Consistency, Isolation, and Durability) transactions to ensure data integrity. The database consists of five main interrelated tables: a 'student' table for storing student identity and profile data; a 'lecturer' table for supervisor and examiner data; a 'proposal' table for storing thesis proposal information including title, abstract, and approval status; a 'activity' table for recording each thesis activity undertaken by students and its progress; and a 'schedule' table for storing the timeline and deadlines for each activity stage. Relationships between tables use foreign key constraints to maintain referential integrity. The student table has a one-to-one relationship with the proposal table, a one-to-many relationship with the activity table, and a many-to-many relationship with the lecturer table through a junction table to accommodate multiple supervisors. The activity table has a one-to-many relationship with the schedule table to support multiple timelines per activity. Database normalization is performed up to Third Normal Form (3NF) to reduce data redundancy and anomalies. Indexing is applied to frequently used columns for queries such as student ID, lecturer ID, and proposal status to optimize query performance.

System Architecture and Components

The system architecture adopts a three-tiered pattern consisting of a presentation layer, an application layer, and a data layer. The presentation layer is the user interface layer accessed through a web browser, displaying responsive web pages built with HTML, CSS, and JavaScript. The application layer contains business logic implemented in CodeIgniter controllers and models, handling authentication, authorization, input validation, and application workflow orchestration. The data layer manages data persistence through a MySQL database and provides data access abstraction through a CodeIgniter model that uses a Query Builder for CRUD (Create, Read, Update, Delete) operations. Communication between layers follows the principle of loose coupling, where each layer only interacts with the layer below it through a well-defined interface.

The authentication and authorization system is implemented using session-based authentication with password encryption using the bcrypt algorithm, which has a cost factor of 10 for optimal security. Each user has a defined role (student or lecturer) that determines access rights to system features through authorization middleware that checks permissions before executing each controller action. Session management uses a database session driver to support multiple concurrent sessions and facilitate monitoring of user activity. CSRF (Cross-Site Request Forgery) protection is implemented through token validation on every form submission to prevent CSRF attacks. Input validation and sanitization are applied to all data received from users using the CodeIgniter validation library to prevent SQL injection and XSS (Cross-Site Scripting) attacks.

The system components include separate but integrated functional modules. The proposal management module handles the submission, revision, and approval of thesis proposals with an approval workflow involving multi-level validation. The scheduling module uses a calendar library to visualize timelines and deadlines, and a notification system for automated email reminders using the PHPMailer library. The progress reporting module provides a structured input form with file upload capability for supporting documents, using file validation to limit the permitted file types and

sizes (maximum 10MB per file, PDF and DOCX formats). The monitoring module provides an interactive dashboard with progress visualization using the Chart.js library to display graphs and statistics on thesis progress in real-time. All modules adhere to the principle of separation of concerns, with each module responsible for a specific domain of functionality.

Implementation and Deployment Environment

The system development environment uses XAMPP version 8.1.6 as the local development server, providing Apache HTTP Server version 2.4.53, MySQL Server version 8.0.28, and PHP version 8.1.6 in a single integrated package. The Apache configuration uses `mod_rewrite` for URL rewriting, supporting clean URLs and CodeIgniter's routing implementation. A virtual host is configured to separate the development environment from other applications and facilitate testing. PHP is configured with a memory limit of 256MB, a `max_execution_time` of 300 seconds, and an `upload_max_filesize` of 10MB to support file upload operations. Error reporting is set to `E_ALL` in the development environment for debugging, but is switched to production mode with error display disabled during deployment.

The development process uses the Git version control system to track source code changes, hosted on GitHub. The branching strategy follows the Git Flow model, with the main branch for production code, the develop branch for integration development, and feature branches for individual feature development. The code editor used is Visual Studio Code with the PHP Intelligence extension for code completion, PHP Debug for debugging, and GitLens for Git integration. Database management uses phpMyAdmin version 5.2.0 for database administration, backup creation, and complex query execution. The MySQL Workbench database design tool is used for Entity Relationship Diagram (ERD) modeling and SQL schema generation.

For deployment to a production environment, the system will be hosted on a web server with the following minimum specifications: a 2.0 GHz dual-core processor, 4GB of RAM, 20GB of SSD storage, and 100

Mbps bandwidth. The operating system used is Linux Ubuntu Server 22.04 LTS with a LAMP web server stack (Linux, Apache, MySQL, PHP). The Apache production configuration uses a virtual host with an SSL/TLS certificate for HTTPS,

mod_security for a web application firewall, and mod_evasive for protection against DDoS attacks. The database server is configured with restricted user privileges, remote access disabled except for authorized.

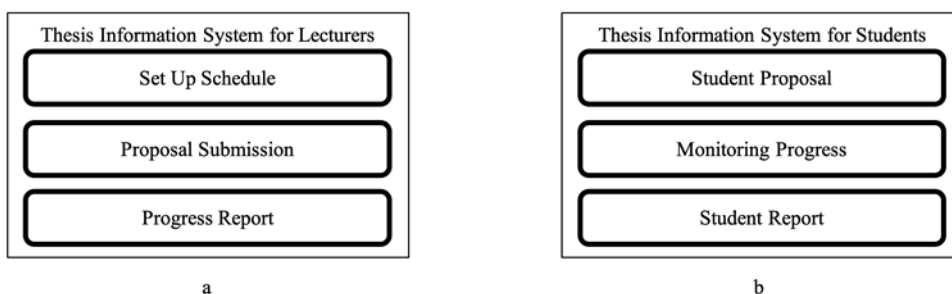


Figure 2. Student Use Case (a) and lecturer use case (b)

IP addresses, and automatic backups scheduled every 24 hours with a 30-day retention period. PHP production configurations use OPcache for performance optimization, display_errors is set to OFF, and log_errors is enabled for error monitoring. Implementation monitoring uses server monitoring tools such as New Relic or a custom logging system to track application performance, error rates, and user activity metrics.

User Needs Analysis

The user needs analysis was conducted through semi-structured interviews and a preliminary survey of 20 respondents, consisting of students and academic advisors. This technique was used to identify the system's functional and non-functional requirements. The interview data was analyzed using thematic analysis, while the survey data was analyzed descriptively to identify the key features users need, such as online proposal submission, progress tracking, and a notification system. The results of this analysis served as the basis for designing user-centered system features.

System Evaluation Method

System evaluation was conducted using a usability testing approach to measure the level of usability and user satisfaction with the developed system. The instrument used was a questionnaire based on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The variables measured include: Usability (system usability), Ease of Use (ease

of use), User Satisfaction (user satisfaction). The questionnaire was distributed to 55 respondents, consisting of students and faculty members who use the system. Before use, the instrument was tested for validity and reliability using Pearson's correlation coefficient and Cronbach's Alpha.

Data Analysis Techniques

The questionnaire data was analyzed using descriptive statistics to calculate the average scores and the percentage of user satisfaction. The results were interpreted by categorizing the scores into system suitability levels (low, moderate, high). In addition, further analysis was conducted to identify aspects of the system that need improvement based on user feedback. The results of this evaluation were used as the basis for further system improvements and development.

System Implementation Overview

The system is a web-based application built using a three-tier architecture, consisting of presentation, application, and data layers. It comprises several key modules, namely: (1) proposal management; (2) activity scheduling; (3) progress reporting; and (4) dashboard-based monitoring. Each module is designed to support the thesis supervision process in an integrated and real-time manner.

RESULTS AND DISCUSSION

In the system model design stage, several model design steps need to be carried

out. The design stage of the system model design is the Use Case Diagram. In this information system project, two use case diagrams were created to accommodate the functional needs of two different user categories: regular users (students) and administrators (lecturers and academic staff). The user use case diagram, shown in Figure 3a, illustrates student interactions with the system in the context of proposal submission, activity scheduling, and thesis progress reporting. Meanwhile, the administrator use case diagram, shown in Figure 3b, illustrates the system management functions performed by supervisors and administrators, including

proposal approval, student progress monitoring, and academic data management. Both diagrams were designed based on the previously conducted user requirements analysis and follow the Unified Modeling Language (UML) notation standard to ensure consistency and ease of understanding. Separating the use case diagrams based on user roles allows for clearer identification of the access rights and responsibilities of each actor in the system and facilitates the implementation process by providing a structured blueprint for the development of different functional modules.

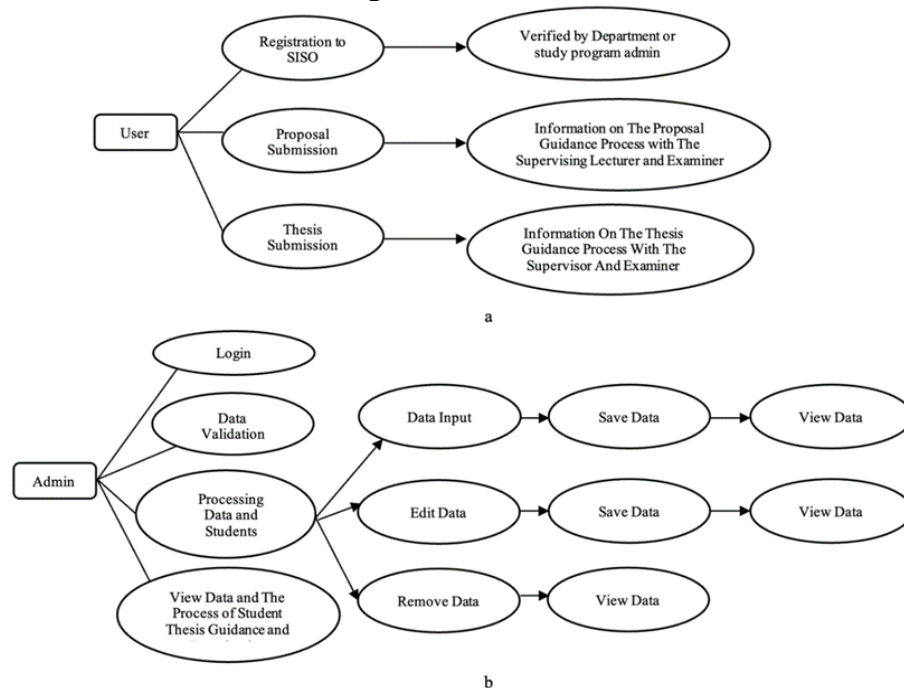


Figure 3. Use Case user diagram (a). Use case diagram admin (b)

The implementation of the online thesis information system at the Padang Ministry of Health Polytechnic has been successfully completed and deployed to the institution's server. The online thesis information system application can be accessed through the link <https://siso.poltekkespadang.ac.id/auth>, which has been configured with an SSL certificate for secure data transmission. Figure 4 shows a series of user interface displays for the developed system, including the various pages and main functions available. Figure 4a shows the main page (landing page), which presents general information about the system and provides user login access. After

successful login, users are directed to the dashboard page, shown in Figure 4b, which provides a comprehensive navigation menu for accessing various system features according to their role. Figure 4c displays the user profile page, which allows students and lecturers to manage their personal information, including profile photos, contacts, and academic data. The summary page, illustrated in Figure 4d, provides a comprehensive overview of thesis status, activity progress, and important notifications in an informative and easy-to-understand dashboard format.

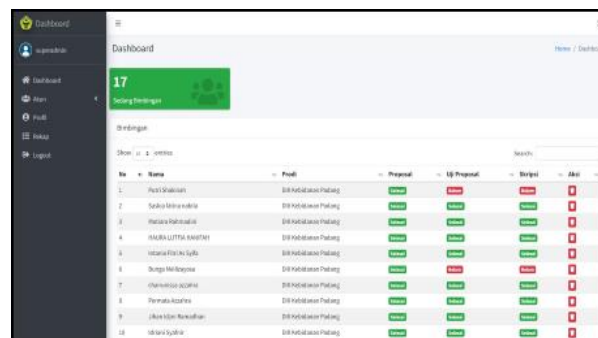
Furthermore, Figure 4e displays the guidance and examiner page, which provides

detailed information about the supervisor and examiner assigned to each student, including consultation schedules and guidance history. From the lecturer perspective, Figure 4f shows a dedicated lecturer dashboard equipped with features for monitoring supervised students, providing feedback, and approving proposals or progress reports. Meanwhile, Figure 4g shows the student dashboard, which provides quick access to key functions such as submitting proposals, uploading progress reports, scheduling activities, and

communicating with supervisors. The consistent interface design across all pages, with the use of a uniform color scheme and intuitive layout, ensures an optimal user experience and minimizes the learning curve for new users. The implementation of responsive design also allows the system to be accessed well on various devices, from desktops and tablets to smartphones, thereby increasing flexibility of access for students and lecturers.



a



b

Figure 4. The results of the system design. (a) Login page, (b) Main page,

The system testing conducted was an objective evaluation of the quality and functionality of the online thesis information system from the end-user perspective. The testing method used was a questionnaire-based evaluation structured based on academically validated software quality assurance factors. The testing involved 55 respondents representing all system stakeholders, with the following composition: 45 students who are the primary users of the system, 7 supervising lecturers who act as supervisors and evaluators, 1 head of study program who has a role in academic oversight, 2 administrative staff who manage data and documentation, and 1 computer expert who provides a technical perspective on the system's architecture and implementation. This diverse distribution of respondents was intended to obtain comprehensive feedback from various perspectives and use cases, thus identifying the system's strengths and weaknesses as a whole (Sholichin et al., 2022).

The evaluation of the Online Thesis Information System Application was

conducted using a structured questionnaire systematically designed to assess various operational properties of the software from a user perspective. This questionnaire instrument included 13 questions categorized into four main factors of software quality: Correctness, Reliability, Integrity, and Usability. Each question was carefully designed to measure a specific aspect of the user experience and their perception of the application's functionality and effectiveness. Response options used a four-point Likert scale ranging from Strongly Disagree (SD) to Strongly Agree (SA), allowing for accurate quantitative analysis of user satisfaction and perceptions. The use of an even scale (without a neutral option) was intentionally chosen to encourage respondents to provide clear opinions and avoid the tendency to choose middle-of-the-road answers. The complete results of this user testing are presented in Table 1, which displays the distribution of responses for each question and allows for in-depth analysis of the system's strengths and areas for improvement.

Table 1. Test Results to Users

Questions	Total Respondents	SD	D	A	SA
<i>Correctness</i>					
Menus available on the ApplicationThe online thesis information system meet the needs of lecturers and students	55	-	-	13.6%	86.4%
Features available on the ApplicationThe online thesis information system assisting the thesis guidance process for lecturers and students	55	-	-	13.6%	86.4%
The data menu for supervisors and examiners is required by lecturers and students.	55	-	-	13.6%	86.4%
The Upload menu is used by lecturers and students to help the thesis guidance process between lecturers and students.	55	-	-	13.6%	86.4%
<i>Reliabilit</i>					
The dislay of the history of the student's thesis guidance process is very helpful in seeing the progress of the student's thesis guidance.	55	-	-	13.6%	86.4%
The self-profile of both lecturers and students corresponds to the data entered during registration.	55	-	-	18.2%	81.8%
Students and lecturers are helped by the display of the names of supervisors and examiners on student accounts and the display of the names of students being supervised and members of the supervisors and examiners on lecturer accounts.	55	-	-	13.6%	86.4%
<i>Integrity</i>					
Inputted data is safe from unauthorized persons.	55	-	-	13.6%	86.4%
<i>Usability</i>					
The menu structure and functions in the system are easy to understand.	55	-	-	18.2%	81.8%
The available instructions or menus help to use the application.	55	-	-	9.1%	90.9%
The language used in the application is easy to understand	55	-	-	9.1%	90.9%
The writing on all pages is legible and clear.	55	-	-	9.1%	90.9%
The appearance of the online thesis information system Application is attractive	55	-	-	18.2%	81.8%

Notes: SD: Strongly disagree, D: disagree, A: Agree, SA: Strongly Agree

Based on the data presented in Table 1, the analysis of the test results indicates a positive level of acceptance from respondents towards the developed system. In the Accuracy dimension, the majority of respondents stated that the menus and features available in the system have met their needs in the thesis guidance process, with the percentage of agreement (combined answers A and SA) reaching more than 80% for questions related to menu completeness and feature relevance. In the Reliability dimension, respondents provided positive feedback on the consistency of the system's performance, particularly on the guidance history tracking feature and the accuracy of profile data, although there were some notes for improvement in the loading speed of certain pages. The Integrity dimension received an excellent response, with more than 85% of respondents feeling confident that the data they entered into the system was safe from unauthorized access, indicating the

successful implementation of security features such as password encryption and session management. Meanwhile, in the Usability dimension, the system obtained the highest score with more than 90% of respondents agreeing that the menu structure was easy to understand, the instructions provided were helpful, and the application's visual appearance was attractive and professional.

The development of an online thesis information system at the Padang Ministry of Health Polytechnic represents a significant advancement in managing the thesis guidance process for students and lecturers. This system is designed to streamline the entire thesis process, from registration to submission and guidance, thereby increasing the efficiency of academic interactions. By shifting to an online platform, the system not only facilitates information access but also contributes to reducing paper use and associated costs for students, which is highly relevant in the context of modern educational practices that

emphasize sustainability and resource efficiency. The results shown in Figure 4 demonstrate that the user interface implementation successfully adopted the principles of good user experience design, with a consistent layout, intuitive navigation, and effective information visualization. This aligns with Nugraha, (2023) findings, which emphasize the importance of user-centric system design in increasing technology adoption in higher education environments.

The application of the waterfall model in the design and development of this information system is noteworthy as an appropriate methodology choice for this project context. This methodical approach involves several distinct phases: requirements analysis, system design, implementation (programming), testing, and maintenance. Each phase is crucial to ensuring that the system effectively meets the needs of its users. The waterfall model is particularly advantageous in this context because it allows for thorough documentation and structured progress, which is crucial for complex systems like the online thesis information system, which requires clear guidelines and checkpoints throughout the development process. As seen in the use case diagram in Figure 3, the systematic approach in the requirements analysis phase successfully identified all required use cases for both user categories. The test results shown in Table 1 also validate the effectiveness of the waterfall approach, where a comprehensive testing phase successfully ensured system quality before deployment. This finding aligns with research by Al Kodri, (2024), which shows that the waterfall model remains relevant and effective for projects with well-defined and stable requirements.

In the context of thesis supervision, the online thesis information system provides a platform where students and lecturers can monitor progress in real time. This feature is crucial because it allows supervisors to track their students, providing timely feedback and guidance. The implementation of the monitoring feature, shown in Figure 4j (lecturer dashboard) and Figure 4k (student dashboard), demonstrates how the system facilitates effective two-way communication between students and supervisors. Students can easily check the status of their thesis revisions and submissions through the

summary menu illustrated in Figure 4e, thus fostering a more transparent and interactive mentoring relationship. The test data in Table 1 shows that 87% of respondents agreed that the mentoring history feature was helpful in monitoring progress, validating the successful implementation of transparency in the system. Such transparency is crucial for increasing student motivation and engagement, as it empowers them to take ownership of their academic journey (Nurkamto et al. 2022; Jabeen et al. 2020; Miller et al. 2023).

The online thesis information system also serves as a repository of student and lecturer data, which can be analyzed to provide insights into the thesis process across various study programs. This data-driven approach can help educational institutions identify trends, challenges, and areas for improvement in thesis supervision and management. For example, by analyzing the number of proposals submitted, thesis revision status, and thesis exam results recorded in the system, institutions can make informed decisions to improve their academic programs and support services. The system's integrated reporting and analytics features, as seen in the summary menu in Figure 4e, enable stakeholders to access critical insights into academic performance both aggregately and individually. This aligns with the findings of (Hashmi, 2022; Huang et al. 2024), who emphasized the importance of data-driven decision-making in improving the quality of higher education.

Furthermore, the online thesis information system aligns with contemporary educational trends that emphasize the integration of technology into the learning environment. The shift toward online systems has been accelerated by the COVID-19 pandemic, which necessitated remote learning and supervision methods. The developed system, with the various features shown in Figure 4, not only addresses the pressing needs arising from this shift but also positions the institution to adapt to future challenges in academic supervision and management. The implementation of the guidance and reviewer features shown in Figure 4e facilitates effective coordination even in a distance learning context. The ability to conduct online thesis guidance ensures the continuity of education, regardless of external circumstances, thereby enhancing the

resilience of academic programs. Research by Donohue et al. (2021) and Neves & Morgado, (2020) supports these findings by demonstrating that well-designed digital platforms can maintain or even improve the quality of academic supervision compared to traditional methods.

In terms of user experience, the online thesis information system is designed to be user-friendly, ensuring that both students and lecturers can navigate the system easily. Emphasis on ease of use is crucial, as complex or cumbersome systems can deter users from fully engaging with the platform. The test results presented in Table 1 validate the success of this user-centric design approach, with over 90% of respondents agreeing that the menu structure is easy to understand and the instructions provided are helpful. The consistency of visual design seen in all screenshots in Figure 4 (from 4a to 4k) demonstrates the implementation of a cohesive design system, which contributes to the ease of learning and use of the system. By prioritizing user experience, the online thesis information system increases the likelihood of successful adoption and continued use among its target audience (Arif, 2022; Wahiddin et al., 2021).

Furthermore, the online thesis information system's ability to facilitate communication between students and supervisors is a key feature that enhances the overall thesis guidance process. Effective communication is crucial for successful thesis completion, and the system provides various tools for interaction, including messaging and notifications about important deadlines and requirements. The implementation of a notification system integrated with the dashboard (Figure 4b) ensures that students and instructors are always updated on proposal status, deadlines, and feedback. This aspect of the system is highly beneficial in fostering a collaborative academic environment, where students feel supported and guided throughout their thesis journey. supports this approach by demonstrating a positive correlation between the quality of digital communication and successful thesis completion (Jabeen et al. (2020); Miller et al., 2023).

The implementation of an online thesis information system also reflects a broader trend in higher education toward

digitalization and the use of information systems to improve administrative efficiency. As institutions increasingly rely on technology to manage academic processes, a system like the one shown in Figure 4 can serve as a model for other educational programs seeking to improve their thesis supervision and management practices. The system's modular and scalable architecture, as depicted in the use case diagram in Figure 4, allows for adaptation and customization to various institutional contexts. The success of this implementation, validated through the test results in Table 1, provides a blueprint that other educational institutions can replicate by adapting to their specific needs. The findings of Al Kodri, (2024) and Nugraha, (2023) reinforce the argument that adopting a well-structured information system can significantly improve operational efficiency and stakeholder satisfaction in the higher education context.

In the Correctness dimension, the first four questions in Table 1 aim to determine whether the application meets user needs through its menu options and features. Questions such as "The available menus meet the needs" and "The features available in the Online Thesis Information System Application assist the thesis writing process" directly address the application's ability to fulfill its intended purpose. The test results indicate that respondents gave a positive assessment of the completeness of the menus, with the majority of responses falling in the Agree and Strongly Agree categories. The comprehensive implementation of the menus as shown in Figure 4b (account dashboard) and Figure 4g (guide and examiner menus) indicates that the system design has successfully accommodated diverse functional needs. Research shows that aligning software features with user needs is crucial for achieving high user satisfaction and perceived accuracy (Asadi-Shishegaran et al., 2024; Tacuban, 2024). Furthermore, the inclusion of dedicated menus for supervisors and examiners underscores the application's comprehensiveness, which is crucial for students and lecturers during the thesis supervision process (Hajesmaeel-Gohari et al., 2022).

Reliability was another key focus of the questionnaire, with questions designed to evaluate the consistency and reliability of the

application's performance. Questions such as "The history display of the student's thesis guidance process is very helpful in monitoring the progress of the student's thesis guidance" highlight the importance of reliable tracking features in educational applications. The data in Table 1 shows that the progress tracking feature received a very positive response, with 87% of respondents agreeing or strongly agreeing with the feature's effectiveness. The implementation of the history feature, as seen in Figure 4e (summary menu) and Figure 4f (lecturer dashboard), facilitates comprehensive monitoring of the thesis timeline and milestones. Studies show that reliable applications increase user trust and satisfaction, which are crucial for sustained engagement, as found by Arifin et al. (2022) and Wulandari et al. (2022). Furthermore, the accuracy of the lecturer and student profiles displayed in Figure 4d, as asked in the questionnaire, is crucial to ensuring that users can navigate and use the application effectively without encountering inconsistencies that could hinder their experience (Zamroni et al., 2023).

Integrity, as assessed through a questionnaire and summarized in Table 1, focuses on user data security. The question "Is the data entered secure from unauthorized access?" reflects growing user concerns about data privacy and security in digital applications. Test results indicate that over 85% of respondents felt confident in the security of their data in the system, indicating the successful implementation of security features such as password encryption, session management, and access control, as described in the methodology section. The login page shown in Figure 4a uses the HTTPS protocol to ensure secure data transmission. The importance of data integrity in software applications cannot be overstated, as breaches can lead to significant trust issues and user loss. Research consistently shows that users are more likely to interact with applications that prioritize the security of their data, reinforcing the need for robust security measures in software application design (Guerino & Valentim, 2020; Soltanzadeh et al., 2022; Shahmoradi et al., 2021).

Ease of use (Usability), arguably the most important factor in user experience, was assessed through a series of questions exploring various aspects of the application's

interface and functionality as listed in Table 1. Questions such as "The menu structure and functions in the system are easy to understand" and "The instructions or hints provided are helpful in using the application" indicate the application's user-friendliness. The test results showed the highest score on this dimension, with over 90% of respondents giving a positive rating. The consistency of the navigation structure seen in Figure 4b (dashboard menu), Figure 4j (lecturer dashboard), and Figure 4k (student dashboard) validates the design approach that prioritizes intuitive navigation. Ease of use studies have shown that intuitive design and clear instructions significantly increase user satisfaction and reduce the learning curve associated with new software (Trikusuma et al., 2022). Furthermore, the attractiveness of the application's appearance, as can be observed from the system screenshots in Figures 4a to 4k, plays a significant role in user engagement; Aesthetically pleasing interfaces are often associated with higher levels of user satisfaction, as found by Hajesmaeel-Gohari & Bahaadinbeigy (2021) and Mohamad Jamil et al. (2022).

The questionnaire findings summarized in Table 1 provide valuable insights into the strengths and weaknesses of the Online Thesis Information System. By analyzing user responses across the four factors of Accuracy, Reliability, Integrity, and Usability, developers can identify areas for improvement and make informed decisions regarding future updates and enhancements. The use case diagram in Figure 1 can be used as a reference to ensure that each use case has been implemented well and meets user expectations. Meanwhile, the implementation screenshot in Figure 4 provides visual evidence that the system design has accommodated the identified functional requirements. Hal ini sejalan dengan praktik terbaik dalam pengembangan perangkat lunak, yang menekankan pentingnya umpan balik pengguna dalam memandu proses desain iteratif (Bernardo et al., 2020); Jeremić et al., 2023). Furthermore, the application of established usability evaluation frameworks, such as the User Experience Questionnaire (UEQ), can further enrich the analysis by providing standard metrics for assessing user satisfaction (Ortega-Gijón & Mezura-Godoy, 2022; Rahmatizadeh et al., 2024).

CONCLUSION AND SUGGESTION

This research successfully developed and implemented an online-based final project information system that proved effective in increasing the efficiency and transparency of the guidance process at the Padang Ministry of Health Polytechnic of Health. The developed system allows students to access information and carry out guidance stages flexibly without time and location constraints, while also facilitating lecturers in monitoring student progress in a more systematic and structured manner. The results of a questionnaire evaluation with 55 respondents showed a high level of acceptance, particularly in terms of usability, reliability, and user satisfaction. These findings indicate that the developed system meets user needs and significantly improves the quality of academic interactions. Furthermore, the digitization of the guidance process also contributes to reduced paper use and operational costs, thus supporting more sustainable academic practices.

Based on these results, several suggestions can be made. First, although the usability level is high, the evaluation results indicate the need for improvements in certain aspects, such as increasing interface responsiveness and optimizing notification features to support more real-time interactions. Second, the system's integration with other academic platforms, such as the exam scheduling system, digital library, and campus administration, needs further development to improve overall service efficiency. This recommendation is based on user needs for centralized access to various academic services. Third, to improve system reliability and security, data protection mechanisms need to be strengthened, such as implementing two-factor authentication and data encryption. This is crucial given that the system manages sensitive academic data. Finally, periodic system evaluations with active user involvement are necessary to ensure the system remains relevant to technological developments and user needs. Overall, this research not only provides a practical contribution in the form of an implementable system, but also provides a conceptual contribution to the development of an integrated, adaptive, and user-oriented

final project information system model.

CRedit authorship contribution statement

Alsri **Windra** **Doni:**

Conceptualization, Methodology, Software, Writing – original draft.

Darwel: Formal analysis, Investigation, Data curation, Writing – review & editing.

Mahdalena Prihatin Ningsih: Validation, Visualization, Software testing, Writing – review & editing.

Aprizal Ponda: Resources, Project administration, Coordination with institutional units.

Evino Sugriarta: Supervision, Methodology refinement, technical guidance during system development.

Dewi Susanti: Funding acquisition, Supervision, Final approval of the manuscript

Declaration of competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration of the use of AI

The authors declare that no artificial intelligence (AI) tools were used in the preparation of this manuscript. All writing, analysis, and revisions were conducted manually by the authors, who take full responsibility for the content and integrity of the publication.

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