



Development of Digital-Based Academic Services System in Higher Education

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Abstract

Utilizing digital technology for academic services becomes a crucial matter nowadays to support effective and efficient academic services in university level. This research sheds the lights on the development of digital-based thesis defense academic services to improve service excellence for the students. The participants of this study are first-semester students and lecturers. We conducted the research under the research and development design, ADDIE (Analysis, Design, Development, Implementation, Evaluation), and mixed method that combined quantitative and qualitative methods. Data collecting techniques included interview, observation, documentation, and questionnaire. The qualitative data were analyzed by using Miles and Huberman model, meanwhile quantitative data were analyzed within descriptive approach. The findings showed that the development of the digital-based academic thesis defense service system is effective in improving the quality and speed of services for students, as well as simplifying academic administrative processes. The system uses digital technology to facilitate easy access, online registration, and document submission, thereby enabling students to register from anywhere and anytime. Implementation trials showed significant improvements in participants' understanding and ability to use the system effectively. This system also supports data transparency and accuracy in academic services at higher education. Based on the findings, this system is recommended to be adopted as flagship program in higher education to support the modernization of academic services.

Keywords: Academic Service, Development Digital, Effectivity, Higher Education, Thesis Defense.

Introduction

The effectiveness of academic services in higher education is one of the key aspects in supporting the success of the higher education process (1, 2). In the era of digital transformation, the use of digital technology in academic services become an inevitable necessity. Digital technology offers efficiency, transparency, and data accuracy in the management of academic administration (3, 4). One of the academic services that is very important to get serious attention is the academic service of thesis defense registration at the master's degree. The academic services for thesis defense registration often require effective coordination. Academic services are a series of activities provided to support students' academic needs to achieve educational goals. Academic services refer to the support of academic activity services including academic registration, short courses,

international students supports, assessment, support for faculty members, including staff and lecturers as well as technological supports for workshops (5, 6), academic guidance, psychological counseling, effective management, responsiveness and career planning (7, 8), easy access to textbooks and libraries, teaching materials, coaching, co-curricular, scientific activities, academic subsidies and foreign language courses (9, 10). These academic services are very important to support quality services, thereby increasing satisfaction (11), and improving the quality of learning for students in higher education (5). The increasingly advanced era requires universities to implement digital technology. The use of digital technology offers flexibility, adapts to student needs, bridges inequalities, and improves digital literacy (12).

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It also offers more benefits like easy academic access, personalized learning paths, assessment tools, collaborative, interactive, self-directed learning, diverse educational content, and more enrichment for learning experience (13, 14). Moreover, it facilitates critical thinking and adaptability (15), and provides access to diverse resources and learning experiences (16). On the other hand, it also increased technical support and a modern learning culture (17). Thus, the benefits of digital academic services encourage easier access, support individual learning activities, increase transparency in educational organizations, optimize interactions, and develop the formation of mobile management structures. In short, it increases the overall effectiveness of the educational process.

However, there are still some higher education institutions that have not utilized digital technology optimally. Our preliminary study showed that academic services for thesis examination registration are still carried out manually, which had an impact on the very slow process of administrative management and decision-making in universities. This argument is supported by findings showing that manual academic services result in data errors, synchronization issues, grade losses, and inefficient information access (18). Furthermore, issues such as reduced accessibility, dissatisfaction with service delivery, and various operational obstacles have also been identified as consequences of manual academic service processes (19, 20). These problems hindered efficiency and long responses (21), limited access to information, reduced transparency, limited access to resources, and raised challenges in building collaboration (22, 23). These kinds of cases will potentially impact satisfaction, decision making and productivity in Higher Education Institutions.

To overcome these problems, higher education institutions need to develop a digital-based academic service system for thesis examinations. This system is a relevant alternative to answer the problems that arise. Digital-based academic services can better integrate administrative processes, minimize manual errors, and speed up the service process to support the modernization of universities. More than that, it can also increase student engagement, facilitate learning experiences, build teamwork, communication and

critical thinking, as well as improve academic performance which ultimately contributes to the quality of education and fosters independence in managing educational workload (24, 25). It can also improve fund management, teaching management, audit/evaluation management and promotion management. Additionally, it can increase student engagement and motivation, leading to increased academic achievement and a more effective learning environment (26, 27). This study aims to develop a digital-based thesis defense academic service system in higher education. By developing this device, it is expected that the academic service process will be more effective, efficient, and result-oriented to boost academic management satisfaction.

Methodology

This research approach aligns with the principles of Design Science Research (DSR), wherein the digital academic service technology system is designed, developed, and evaluated to address real-world problems in higher education. The iterative design process, stakeholder involvement, and systematic evaluation are consistent with the core components of the DSR methodology. The research stages can be outlined as follows:

Research Design

This study used Research and Development method with the ADDIE model approach which includes five stages: Analysis, Design, Development, Implementation, and Evaluation. This model was chosen because it was systematic and relevant to develop a product in the form of a digital-based thesis defense registration system. This research approach used a mixed method that combined qualitative and quantitative approaches.

Population and Sample: The population of this study was students and lecturers of the postgraduate study program. The sample was 12 first-semester students and 5 lecturers. We set some criteria to recruit the students as our research sample. We chose only freshman or first semester students of academic year 2024 who were officially registered as postgraduate students. Furthermore, the lecturers that became the participants of this research were postgraduate lecturers.

Data Collecting Technique: Data collection techniques included interviews to explore students' perceptions, experiences, and needs

related to academic services for thesis examinations; observations to investigate the academic service process for registration of thesis defense carried out manually or digitally; documentation studies to analyze data related to administrative procedures; and questionnaires to collect quantitative data from students related to the effectiveness of the developed system.

Research Instrument: The instruments of this research were designed based on each stage of the ADDIE model used in this research. The components of analysis stage included identification of needs, constraints, procedures and requirements as well as digital features. The design stage included specifications, system design, and product validation design. In development stage, we focused on system prototype creation, system integration, expert testing, and improvement. Next, implementation stage was conducted to run the system trials. Lastly, evaluation stage was conducted to measure the level of users' satisfaction based on the participants' perspective.

Data Analysis: Data analysis was conducted by using two approaches, namely: Qualitative data analysis by using the Miles and Huberman model which includes data reduction, data presentation, and drawing conclusions; and Quantitative data analysis by using descriptive analysis to describe the effectiveness of the system based on questionnaire data. Through this research method,

it was expected that the development of a digital-based thesis examination registration system could make a significant contribution to improving the quality of academic services in higher education.

Results

In the analysis stage, we identified the needs of academic services for thesis examinations, the constraints, manual administrative workflows for academic services, and feature preferences desired by students and lecturers. The results of observations and literature studies indicated that academic services for thesis examinations were mostly held still manually. Academic services still did not use standardized digital exam registration forms and exam validation sheets. According to academic service staff:

"To register for a thesis examination, students must come to campus to register for a thesis examination by filling out the registration form and completing the exam registration requirements. Registration requirements consists of a hard copy of the thesis manuscript and other supporting documents."

The problems of academic services for thesis examinations were then analyzed using a fishbone diagram. The results of the analysis obtained 4 (four) main root problems, namely Man, Material, Method, and Machine. The results of the analysis can be seen in the following image:

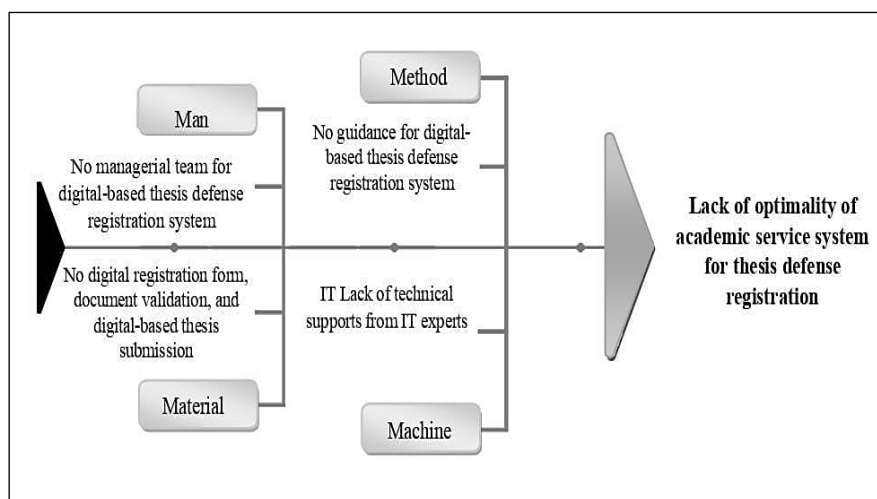


Figure 1: Problem Analysis with Fishbone

Figure 1 presents a fishbone diagram used to identify root causes of inefficiencies in the thesis examination registration process. These factors contribute to delays in academic services, particularly in the context of thesis exam registration for students. The results of the analysis

on the fishbone diagram conducted by referring to the 4M category, namely: Man, Material, Method, and Machine, showed several root problems of the academic service system for thesis defense registration that were not yet optimal. Man referred to the absence of a thesis exam

registration system management team. On the other hand, material deals with the absence of a thesis registration and validation form. Furthermore, problem in method was about the unavailability of a thesis exam registration system guide. Lastly, problem in machine related to the lack of technical support from IT experts. As a result, academic services to students were less than optimal.

The design stage is the stage for designing a digital-based academic service program for thesis defense. The initial activity was the selection of the academic service method for thesis defense. The method chosen was digital-based academic service. The results of interviews with participants revealed that the plan to use digital methods would support the effectiveness of services to students. According to participants:

"The use of digital methods in academic services for thesis defense registration is very helpful for students in terms of material, time and energy. With a digital basis, students can register anytime and anywhere, registration is automatic, and communication is faster".

The digital applications used were google site and google form. The google sites application was chosen because it has the advantages of being free and easy to access. Users can add text and videos; integrated with google drive, google docs, google sheets, google slides, and google forms. Google forms were integrated with google sites, free hosting and storage, templates and easy collaboration. Then the design of guidelines, procedures and requirements for academic

services, and validation of products and usage guides were carried out. The main objective of this stage was to design a digital-based academic service program for thesis defense to achieve the goal of effective service to students.

The designed academic service system includes a set of user modules, such as the digital academic registration module, a document validation module for staff to review uploaded documents, and a status monitoring module that allows students to track the progress of their registration within the system. These modules are integrated using Google Forms and Google Sites, facilitating smooth communication and task delegation. Additionally, the system features automatic status notifications, enabling students to receive real-time updates.

The development stage was prepared to create the product. Product creation included creating pages, components, content, registration procedures, registration requirements, and registration guides. The academic service product was then validated by a team of media experts and material experts. The purpose of product validation was to obtain suggestions and input to be in accordance with the objectives of developing the academic service product. The validation process was conducted by using an instrument sheet with a Likert scale. Based on the validation results, we revised our product by considering the given suggestions and recommendations from the validator. The following is the academic service procedure for registering for thesis exams:

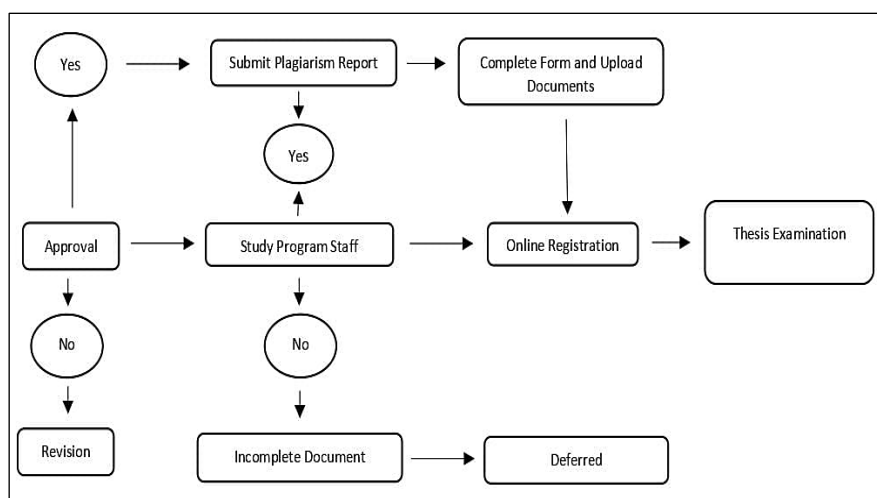


Figure 2: Procedures of Thesis Defense Registration

In Figure 2, it can be explained that the procedure for the academic service flow for digital-based thesis examinations is that students who have received approval should inform the study program staff. After that, they have to submit a plagiarism test result and the staff will inform the student to continue the registration process through the system. Then, the student registers for the thesis examination in online basis by filling out the form and uploading the required file documents. The registration requirements include an approval sheet, consultation book, statement of full tuition fees, seminar certificate, workshop certificate, training certificates, proof of plagiarism-checker, latest academic transcript, letter of free book-borrowing from University

library, electronic document of thesis, and manuscript of published articles. Figure 2 illustrates the step-by-step procedure of the digital academic service, specifically for thesis examination registration. The process begins with supervisor approval, followed by the submission of a plagiarism report. Based on the validation process, applications may proceed, require revisions, or be suspended. Each decision point in the flowchart is labeled with Yes/No paths to indicate the conditional actions and responsibilities between students and administrative staff. The validation results from the digital expert validator can be seen in the following Table 1:

Table 1: Validation Results of Digital Product

No	Aspect and Indicator	(%)	Category
A	Interface		
1	Interesting interface	100	Very good
2	Complete activity interface	75	Good
	Average	88	Good
B	Access		
1	System is easy to access	75	Good
2	Easy login and sign out process	100	Very good
	Average	88	Good
C	Interaction		
1	The system ease students to interact with study program or department via online	87	Good
2	The system facilitates the students to register their thesis defense via online basis	100	Very good
	Average	94	Very good

Based on the validation results in Table 1 above, it is stated that the interface and access aspects got an average value of 88. It can be said that the result is good as it is categorized. The interaction aspect gets an average value of 94 which is categorized as Very Good. However, we paid more attention into

the attractiveness and the ease of access of the system we designed as they got low rating from the validator. Furthermore, the validation results of the guidebook can be observed in the following Table 2:

Table 2: Validation Result of Guidance Book

No	Aspect and Indicator	(%)	Category
A	Usability Aspect		
1	The guidance book eases the online registration process of thesis defense	87	Good
2	The guidance book shortens the time allocation of thesis defense registration	87	Good
3	The guidance book encourages students and lecturers to use digital facilities for academic activities	87	Good

4	The guidance book encourages the lecturers and students to improve the usage of digital-based thesis defense registration system	100	Very good
	Average	90	Good
B	Feasibility Aspect		
1	The guidance book is more practice to be used	100	Very good
2	The guidance book eases the users to understand the function of the system	87	Good
3	The guidance book eases the users to understand the procedure of the system	87	Good
4	The guidance book eases the users to understand the system requirements	100	Very good
5	The guidance book is suitable to be published as guidance in using the system	100	Very good
	Average	95	Very good
C	Suitability Aspect		
1	The guidance book is suitable with students needs for thesis defense registration	87	Good
2	Theoretical literature in the guidance book is suitable with the development of digital-based thesis defense system	100	Very good
3	The guidance book is written systematically and comprehensively	100	Very good
	Average	96	Very good

Based on the validation results of the guidebook in Table 2 above, it is stated that the usability aspect got an average value of 90 which is in the good category. Furthermore, the feasibility aspect gets an average value of 95 which is in the very good category. As for the aspect of the suitability of the average value of 96 which is in the very good category. The validators suggested that improvements were needed on the cover of the guidebook because there were writing errors. Furthermore, it took time for the thesis exam to be carried out around two weeks after registration.

The validator concluded that the product was suitable for use at the trial stage with minor revisions.

The implementation stage is aimed for the product trial. We asked the lecturers and students to be involved in this stage. They were the first to try using the product. The purpose of this stage was to ensure that the academic service program could be run smoothly and effectively. The results of the pretest and posttest on students and lecturers are shown in the following Table 3:

Table 3: Pretest and Post-Test Results

No	Aspect	Pretest	Category	Post-test	Category
1	Technological based and information-based services give many benefits to the students	100	Very good	100	Very good
2	The manual registration process for thesis examinations requires students to be physically present on campus to complete the registration form.	91	Very good	100	Very good
3	The concept of Googlesite as platform	100	Very good	100	Very good
4	The concept of thesis defense	100	Very good	100	Very good
5	The benefits of using the guidance in using the digital based thesis defense registration system	66	Sufficient	91	Very good

6	The first procedure in digital based thesis defense registration after receiving supervisor's approval	66	Sufficient	83	Good
7	The requirements of digital-based thesis defense registration	75	Good	100	Very good
Average		85	Good	96	Very good

Based on the results of the product trial on students and lecturers, the average pretest result to measure the mastery of the material was 85. It falls into the Good category. Another result of the pre-test showed that the mastery of the benefits and procedures of the system was in the Sufficient category. Furthermore, the average post-test result was 96, with the very good category. It can be seen that there was an increase in the abilities of the participants before and after the trial was conducted. The suggestions that we got from this trial are to use a simple, clearly responsive design and simplify the procedures. Throughout the

development and implementation process, program heads actively contributed strategic direction to support the policy of digitalizing academic services. The implementation team provided technical training to administrative staff and faculty members through workshops on system usage.

The evaluation stage is aimed to measure the effectivity of the digital-based academic service. The evaluation results were used to further fix and develop the program of this digital-based thesis defense academic service. Here are the results of evaluation stage in the following Table 4:

Table 4: Trial Evaluation

No	Aspect	Result	Category
1	Invited Speaker	92	Very good
2	Time management	87	Good
3	Material	89	Good
4	Committee	86	Good
5	Facilities	87	Good
6	Method	87	Good
Average		88	Good

Based on the recapitulation results in the table, it shows that overall, the trial evaluation received a positive assessment with an average assessment of 88 and categorized as Good. The benefit of this academic service was that thesis exam registration could be done anytime and anywhere, so it made the process easier. In addition, students could monitor the registration status so as to increase transparency. It saved their time, costs, and energy. Moreover, it also encouraged creative and innovative thinking and improved users' digital literacy and skills.

Each research phase demonstrates that this digital academic service system has a significant positive impact on administrative efficiency. The system reduces thesis exam registration processing time from several days to a matter of minutes, enabling immediate submission and validation. It also allows students to complete forms and upload documents independently, thereby reducing the administrative workload. Digital feedback from

staff minimizes communication errors and manual data entry mistakes. As a result, transparency and accessibility are improved, enhancing student satisfaction. In the future, academic programs could expand the system to monitor students who fail to register on time, supporting early identification of dropout risks.

Discussion

The analysis stage showed that thesis defense academic services are still carried out manually. Manual academic services cause the quality of service to students to be less than optimal (28–30), and are less effective because they require a lot of time, materials and energy (31–33). This is due to some factors such as limited human resources, lack of facilities, and the absence of clear academic service procedures (11, 34–36). The level of satisfaction and quality of service to students is decreasing. Preliminary evaluations indicate an organizational culture shift supporting digital

transformation, despite initial resistance from administrative staff accustomed to manual processes.

The design stage was carried out by selecting an academic service method. The method used was digital-based approach. The use of digital-based academic service methods in higher education aimed to increase efficiency, facilitate access to academic information and increase data accuracy; academic information was carried out openly and transparently, supporting communication and collaboration (37–40). Then, the use of digital platform was expected to encourage automation and integrated systems, so it could make the service times become faster and more responsive (41–43). It allowed for quick decision making, saved costs and adapted to technological developments (20, 44, 45). Moreover, the design of academic service procedures and requirements could be a strategic tool to support transformation of higher education towards a more modern and competitive higher education ecosystem (46–49). The development stages included the creation of digital-based academic service products and guidelines. The results of product development were validated by a team of experts who aimed to obtain quality academic service products. The criteria for the success of creating products and guidelines were suitability to user needs, ease of access, important features, ease of maintenance, and data security (50–52). Our digitally integrated academic service products were validated by experts. Expert validation aimed to ensure quality, check suitability for academic purposes, increase reliability, ensure ease of use, meet technological standards, increase trust, avoid misinformation and have a positive impact on users (53–56).

The results of the product trial at the implementation stage were in the very good category. It is proven that digital academic service products were able to increase the effectiveness of services to students. The trial results showed an increase in participant abilities before and after the trial was conducted. The digital academic services are more effective because they can be accessed anytime and anywhere and encourage time and cost efficiency. Data and information in this device are more updated and it also can track the progress of submissions. There are automatic notifications, and information is more open (57–61). Therefore, digital academic services support the strategic goals of higher education institutions in creating a

more efficient, responsive, and future-oriented educational environment based on information technology (60, 62–66).

The evaluation results of each stage including the analysis, design, development and implementation stages run effectively to improve the performance of academic services to students. A product can provide satisfaction because it is in accordance with needs, easy to access and can be used (67–69). The planning and implementation of academic service products are in line with the impact on the effectiveness, quality and satisfaction of users in higher education (11, 70, 71).

In the context of global higher education, various universities have implemented strategies toward digital transformation to optimize academic services for students (16, 72). These strategies are aligned with the global shift towards data-driven and automated systems in higher education. Examples of institutions adopting digital management systems to enhance administrative efficiency include the Technical University of Moldova (73), and Borys Grinchenko Kyiv University (74). Nonetheless, the system developed in this study presents a low-cost, more accessible solution for students and is particularly suitable for higher education institutions with limited infrastructure.

This system offers advantages over conventional models. The digital academic service system discussed in this study provides more targeted, flexible, and cost-effective solutions, particularly concerning thesis examination registration for postgraduate students. It enables online registration, faster document validation, more flexible timing and location, and automatic feedback. These advantages are not present in the previously practiced manual registration system. Thus, the implementation of this system in higher education institutions reflects a student-centered service design process, particularly in academic service delivery related to thesis examination registration.

This study has limitations because the sample used was only students at one particular university. In the future, this research is expected to be carried out on a wider scale with samples from various universities, different regions, and although initial usability evaluation was conducted through descriptive surveys and expert validation, future research is recommended to utilize standardized instruments such as the System Usability Scale

(SUS) or the Technology Acceptance Model (TAM) to comprehensively assess student usability, acceptance, and satisfaction. While the system has shown positive outcomes in improving efficiency and transparency, it relies on internet access and Google-based platforms, which may limit its functionality in areas with poor connectivity. Additionally, the initial resistance from administrative staff stemmed from limited digital literacy. Therefore, digital literacy training, plans to migrate the system into the institution's official Learning Management System (LMS) for long-term sustainability, and the involvement of digital professionals are necessary. These steps are expected to strengthen the system's quality in the future.

Conclusion

The development of academic services for thesis defenses to improve the effectiveness of services to students in terms of analysis, design, development, implementation and evaluation has been proven to be categorized as good. Digital-based academic services are effective in improving the quality and speed of responses and services to students, as well as simplifying the academic administration process in universities. This system supports transparency and accuracy of academic service data for thesis registration. Based on research findings, this system is recommended to be adopted as a flagship program in universities to support the modernization of academic services. However, a simple, clear and responsive design is needed, and simplification of procedures or clearer explanations can help. Further research is expected to be carried out on a wider scale with samples from various universities and different regions.

Abbreviations

ADDIE: Analysis, Design, Development, Implementation and Evaluation, R and D: Research and Development, 4M: Man, Material, Method, and Machine.

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Author Contributions

Marinu Waruwu: Conceptualization, data collection, analysis, writing, review, editing, Halida: Data collection, analysis, review and editing, Muh Takdir: Investigation, and review, editing, Yari Dwikurnaningsih: Analysis, investigation, review, editing, Lilis Kholisoh Nuryani: Analysis, review, editing, Sophia Tri Satyawati: review, editing, Wati Irnawati: editing.

Conflict of Interest

Authors have no conflict of interest to declare.

Declaration of Artificial Intelligence (AI) Assistance

The authors declare no use of artificial intelligence (AI) for the write-up of the manuscript.

Ethics Approval

Not applicable.

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