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Article

The Development and Implementation of System Information Management "LabSains 1.0" for Supporting Practicum Activities in FTIK Laboratory at IAIN Ponorogo

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ABSTRACT

The controlling record data for the FTIK laboratory at IAIN Ponorogo relies on conventional methods. These methods have encountered several challenges. The inventory recording of the laboratory, reagents, and scheduling is conducted through manual entries in a notebook. The management of these methods presents multiple challenges. This research aims to develop a laboratory management information system to address the problem of laboratory service efficiency at FTIK IAIN Ponorogo. Optimization of laboratory management in supporting student activities is carried out through a management information system. The development of the "LabSains 1.0" system at the FTIK Laboratory is the first pilot project for laboratory digitization within IAIN Ponorogo. The system development uses the waterfall method to follow the systematic flow needed in software creation. The operational efficiency results of using the "LabSains 1.0" system reach a moderate rate at a ratio of 74%. This study focuses on three main efficiency indicators, including enhancing service quality, reducing errors in the organization, and increasing user satisfaction. 86% of students stated strongly agree with the use of the system in the laboratory. The professional development and implementation of "LabSains 1.0" systems have improved laboratory competitive services. These organizing activities can provide benefits through an automated system that features comprehensive document processing capabilities.

INTRODUCTION

The digital disruption significantly affects the digitization of the education corporation industry. The utilization of technology influences equitable educational access under various conditions. (Fitriani Lubis, 2019) The utilization of technology pertains to the process of enhancing individual competency. The implementation of digital technology facilitates the comprehensive and effective integration of data. Furthermore, the deployment of technology or information systems within educational entities must be accompanied by thorough planning and training for the system users. (W. A. Prabowo & Wiguna, 2021) Institutional supervisory activities, including the regulation of data collection processes, can be executed efficiently through the means of digital technology. (Burkov et al., 2015) The efficiency of information

technology in the education corporation industry must be accompanied by the provision of adequate infrastructure, the improvement of human capabilities, and policy design to support the implementation of technology within educational organizations.(Febrianti et al., 2023)

Field research indicates that one of the supervisory functions conducted within an educational institution encompasses the management of laboratory administration activities, including laboratory administration control activities. The meaning of laboratory, based on a "Kamus Besar Bahasa Indonesia," is a certain place equipped with equipment to conduct experiments in higher education institutions. The laboratory is a unit that is attached under the supervision of the faculty. (KBBI, 2024) Laboratory control often faces challenges in the availability of reagents and the recording system used during laboratory practicum. The use of a notebook to record reagents causes delays in reporting their availability. (Hasanuddin, 2021) The implementation of management information systems for recording reagents in the laboratory can be tailored to meet the user's needs. Developing and implementing a management information system in the laboratory can enhance students' ability and proficiency in controlling the laboratory efficiently. Previous research has shown that technology-based laboratory management positively impacts students' hard skills. (Gamage et al., 2020) These organizing activities can provide benefits through an automated system that features comprehensive document processing capabilities.

The controlling record data for the science laboratory at FTIK IAIN Ponorogo relies on conventional methods. These methods have encountered several challenges. The inventory recording, reagents, and scheduling are conducted through manual entries in a notebook. The management of these methods presents multiple challenges, resulting in negative impacts on the quality of student services within the laboratory.(Pengelola Lab, personal communication, April 2024) The scheduling of science laboratory sessions is executed via a manual process coordinated through group WhatsApp messages. Improper scheduling can lead to conflicts or issues concerning the utilization of laboratory hours. Concurrent experiments may arise as a consequence of overlapping schedules. (Personal communication, April 2024) The science laboratory possesses a limited inventory, which includes analytical scales, test tubes, Erlenmeyer flasks, and other equipment. The borrowing of equipment is facilitated through coordination between students and laboratory personnel via WhatsApp messages, which are carried out through coordination between students and laboratory officers through WhatsApp messages (Personal communication, 2024).

Conventional recording in the data collection of goods stock has the potential to cause missing information. Monitoring the inventory in real time can be done using a management information system using a first-in in first-out approach. Recording of goods information, delivery of stock from suppliers, and expenses of goods can be printed in integrated digital reports. (Dedy et al., 2024) Optimizing laboratory control to support practical activities can be achieved through the application of technology. This research aims to develop an information system, "LabSains 1.0", as a digital assistant for managing the science laboratory at FTIK IAIN Ponorogo. Students' critical or creative thinking abilities can be enhanced through the execution and outcomes of the practicum (Yanti et al., 2023). Additionally, it aims to improve the skills of FTIK IAIN Ponorogo students in implementing digital-based laboratory management. This research focuses on laboratory administration. The use of this technology is associated with becoming a more competent individual. The "LabSains 1.0" information system at the Faculty of Science Laboratory is the first pilot project to digitize the Science Laboratory within IAIN Ponorogo. These organizing activities can provide benefits through an automated system that features comprehensive document processing capabilities.

METHODS

The research procedure applied is waterfall methodology. The waterfall methodology is a management information system development method that is appropriate for use on a medium

scale of development. The methodology has sequential work requirements, including the stages of planning the system concept, designing the system, implementing the system, testing the system, and maintaining the system.(Ramadhan et al., 2023) In system design, the network procedure approach is interconnected to achieve the final goal of the system design. Some of the important menu features in a management information system include the ability to integrate data from various comprehensive sources stored in the database. Data display features in the form of graphical graphics, images, and reports. The feature analyzes the data interactively and massively. (Yoraeni et al., 2023) Information system design is an innovation in creating a new system or in improving a system that has previously been running.(M. Prabowo, 2020) (Santoso et al., 2025)

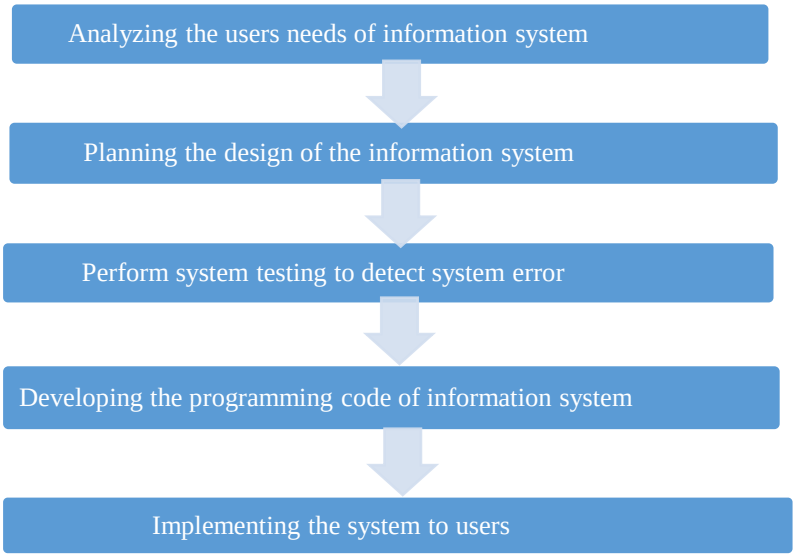

Figure 1. Waterfall Flow Chart

The operational efficiency ratio of the "LabSains 1.0" system was carried out using quantitative methods. Each laboratory student fills out a questionnaire containing nine questions based on operational efficiency indicators. Respondents in this study had a frequency of laboratory use between 3 to 7 visits. Measurements are made based on Likert scales of 1-4. Scale 1 refers to statements strongly disagree, scale 2 refers to statements of disagreement, scale 3 refers to the scale of agreement, and scale 4 refers to the scale of strongly agree. Based on the theory of operational efficiency, this study focuses on three main indicators of efficiency. The primary indicator serves as a parameter of operational efficiency within the context of implementing the management information system in the laboratory. The indicators examined include enhancing service quality, reducing errors in the organization, and increasing user satisfaction.

Table 1. Reference Effectiveness Ratio

Effectiveness Ratio	Attainment Rate
0-40	None
40-55.99	Low
60-79.99	Moderate
80-100	High

(Litbang Depdagri, 1991)

RESULTS AND DISCUSSION

1. Analyzing users' needs

The controlling record data for the science laboratory at FTIK IAIN Ponorogo relies on conventional methods. These methods have encountered several challenges. The inventory recording of the laboratory, reagents, and scheduling is conducted through manual entries in a

notebook. The procedure for using the FTIK laboratory includes filling out a research permit, filling out a tool loan form, filling out the laboratory use schedule, submitting the supervisor's approval, to the stage of verifying the permit and form by the laboratory coordinator. (SOP FTIK IAIN PONOROGO Laboratory, 2024). Standard operating procedure (SOP) for using laboratory facilities in the FTIK Laboratory must be able to carry out equipment operation, equipment maintenance, reagent maintenance, work system evaluation, and laboratory development activities. Laboratory SOPs are expected to be implemented properly. In conditions where standard operating procedures do not run well, it harms laboratory administration activities. The conventional method presents multiple challenges, resulting in negative impacts on the quality of student services within the laboratory. The scheduling of science laboratory sessions is executed via a manual process coordinated through group WhatsApp messages. Improper scheduling can lead to conflicts or issues concerning the utilization of laboratory hours. Concurrent experiments may arise as a consequence of overlapping schedules.

Table 2. Laboratory Problems with the Conventional Method

Parameter	Problems That Occur
Laboratory Equipment	- Equipment availability cannot be known in real time - Loss of equipment - Appliance malfunction occurs
Reagents Stock	- The type of reagents has not been properly recorded - The amount of reagent available is not known in real time
Laboratory Scheduling	-Clash of laboratory use schedules by practitioners

Source: Data Record, 2024

Based on the existing condition, several features on the “LabSains 1.0” need to be developed, including the reagent, schedule, and equipment features. Some of the important menu features in a management information system include the ability to integrate data from various comprehensive sources stored in the database. The flow of the database system should be created based on the needs of the user. Data display features in the form of graphical graphics, images, and reports. The feature analyzes the data interactively and massively. Notification features and the ability to interact with other systems. The following outlines several concepts for the planning of features within the "LabSains1.0" information system.

Table 3. Analysis of User Features

Respondent	Necessity	App Features
Students	Adding laboratory equipment	E-Form added tool
	Added Reagents	Reagents E-Form
	Scheduling laboratory use	Scheduling E-Form
Laboratory Officers	Identity of the laboratory student	Student Database
	Laboratory schedule data	Scheduling database
	Stock opname of laboratory equipment	Equipment database
	Stock opname reagent	Reagent database

System analysis constitutes an activity that describes the components of the information system, aiming to elucidate the relationships between these components to identify potential errors within the system. The system analysis is conducted through the documentation pertinent to the system. The documentation of the analysis results will be preserved in a repository, containing various forms of data, including reports, spreadsheets, calculations, and so forth. (Prof. Dr. Sri Mulyani, 2017) Institutional control activities, such as collecting administrative data, can be executed efficiently through digital technology. (Burkov et al., 2015) Comprehensive knowledge of system features is needed to improve user understanding, thereby reducing the occurrence of misuse of menu features in the system. (Yoraeni et al., 2023).

2. Design Features of "LabSains 1.0"

The design plan of the "Lab Sciences 1.0" information system was developed based on the results of field research and interviews conducted with students and the laboratory officer of the FTIK laboratory. The main problems that arise include recording the flow in and out of laboratory equipment, the flow in and out of recording reagents, and recording the student schedule of laboratory use. Based on the description of the problem, the management information system developed has an inventory function and a scheduling system. "LabSains 1.0" used the concept of inventory management using an online-based based. Inventory can lead to the realm of technological development in the scope of recording incoming and outgoing reagents and equipment. The application of technology can optimize laboratory management/governance in universities. The following is the design of the menu features used in the Lab Sciences 1.0 information system.

Table 4. Featur Menu "LabSciences1.0"

	Menu	Description
1	Home	The features are 5 main menus, including the menu on how to use the system, FAQ, Team, E-Form, and Log In.
2	Procedure	The feature contains an explanation of the use of E-Forms
3	FAQ	The feature presents several reviews of questions related to the LabSains 1.0 application system.
4	Team	This feature explains the organizational structure in the management of the Laboratory.
5	E-Formulir	This feature is used as a place to collect data
6	Log In Admin	on requests for laboratory equipment and reagents. This feature contains student data to log in by filling in the user's identity and password.

The inventory function is closely related to the storage of inventory in the warehouse. The laboratory inventory cycle can be easily and in real time known through information systems.(Dzukha Asyiqin, 2022) The Scheduling Information displayed in the system will facilitate the process of planning the use of the laboratory by students. (Manalu et al., 2022). The development of the LabSains 1.0 system is to support the expectations and needs of users.(Magdalena et al., 2024). Based on Changyou Wei, the management of university laboratories can be managed through the application of technological frameworks using computer systems. The application of technology in laboratories has a strategic function in evaluating laboratory work and reducing laboratory safety hazards. (Wei, 2020). In this research, " LabSains 1.0," the data control process is related to the flow of laboratory reagents using the concept "First In, First Out" principle approach. The input data are reagent stock, added laboratory equipment data, and laboratory schedule. In the next database processing, the user will get the output data containing updated data of reagent stock, equipment, and laboratory schedule.

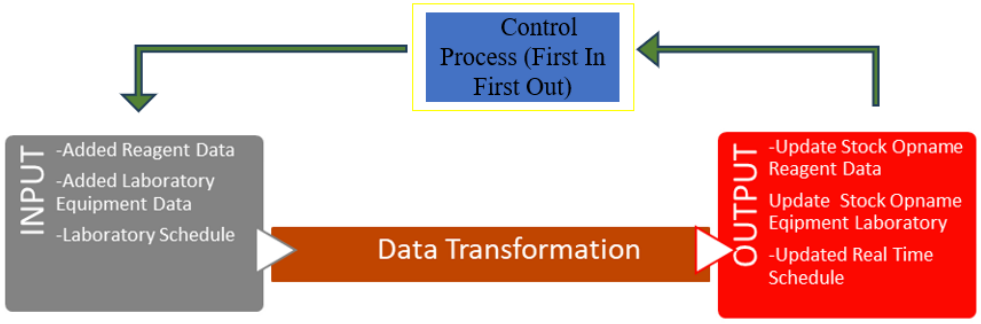

Figure 2. LabSains 1.0 Information System Flow Chart

3. Design User Interface (UI)

The appearance of the initial page design on the “LabSains 1.0” system has a white and blue user interface. The menu feature "Home, Procedures, FAQs, Team, E-Forms, and Log in Admin" is located in the upper right corner. Suitability user interface design in system development is expected to have a flexible website display on all types of devices, both desktop and smartphone displays. The user interface is expected to be developed concisely. The user interface design is expected to be developed simply and naturally. Color contrast should be carefully developed so that users can easily read the writing on the system. In the design of information system architecture, the development process is carried out in an organized, effective, communicative, and harmonious color combination.(Sulianta, 2019)The display of information is structured and easy to understand.(Dr. Wahyudin et al., 2024)

Figure 3. Interface Desain “LabSains1.0”

The "LabSains 1.0” system is designed with three main menus, namely a menu of schedule information, equipment inventory, and reagents. The menu feature of inventory tools and consumables will be designed based on *the theory of inventory/warehousing* of tools that focuses on data collection of the grouping of types of reagents, number of reagents, storage of reagents, and *expired* reagents. The form of efforts to meet the needs of users in information system development is based on user characteristics. Meeting the needs of *users* or system users is crucial in developing an information system design. Information systems developed to meet the needs of users play a role as facilitators in accommodating users' expectations. The information system is expected to be able to play a role by providing the best performance as a competitive system (Heijs, 2022).

Figure 4. Design Fitur Menu “LabSains1.0”

The E-Form Menu feature is designed based on the conventional methods pattern of Laboratory FTIK . The form of adoption of this pattern is expected to make it easier for student to fill out the E-form. The user experience of "LabSains 1.0" system is expected to be developed with a user-friendly strategy. Design planning can be done through design thinking. The use of design thinking in designing user experience analysis can provide a comprehensive picture of user needs. The implementation of design thingking through the empathize stage is the stage of feeling, and experiencing the feelings of the users, define is the stage of making a list of user problems, ideate is the stage of developing ideas based on user needs, prototype is the stage of implementing ideas in test products, and tests is a test stage to determine the suitability of the system form on the user (Ilham et al., 2021).

Figure 5. E-Form for Borrowing Laboratory Inventory Equipment and Reagents

The LabSains 1.0 system is expected to meet the needs of users. Student in FTIK Laboratory need an easy access system in the laboratory. All of the laboratory students are Gen Z users who need a system with a good visual interface design and minimalistic layouts. In experimental psychology, there are basics in conducting a formal evaluation of performance and opinions that occur between humans and computers. Information systems and human matchmaking must be aligned based on user traits, user habits, user perceptions, and motor skills.(Dr. Wahyudin et al., 2024) Various types of information systems require evaluation for the functionality and performance of the information system.(Haering et al., 2021) The evaluation process is very important to be carried out with the aim that the system has good performance capabilities in supporting and increasing educational activities.(Papadakis, 2021)

4. Validation and Performance of "LabSains 1.0" System

The results of expert validation explained that log In, reagent E-Form, schedule E-Form, and equipment E-Form menu features have access at an easy level. The Reagent database feature has access to the youth of use at a moderate level. The schedule database menu feature has access to a moderate level of use. The laboratory equipment database feature has access to the youth of use at a moderate level. Based on this verification, it is known that the E-Form has easy access to use, but the database feature has a moderate ease of access. Based on these conditions, it is necessary to increase user access to the reagent database menu features, schedule database, and laboratory equipment database in order to have an easy level of access for use by evaluating the flow of the database system. Comprehensive knowledge of system features is needed to improve user understanding, thereby reducing the occurrence of misuse of menu features in the system (Yoraeni et al., 2023).

Table 5. Validation of Menu Features

No	Menu Features	Access Usage		
		Easy	Medium	Hard
1	Log In	√		
2	Reagent E-Form	√		
3	Schedule E-Form	√		
4	Laboratory Equipment E-Forms	√		
5	Database Reagent		√	
6	Schedule Database		√	
7	Laboratory Tools Database		√	

The *performance* of the "LabSains 1.0" system showed the time required to display the first page frame row of the system. The system has a display performance time span of 5.38 seconds. This shows that the system has a fast loading time. Users can feel directly that the display will be present in a short period of time (5.38 seconds). The system design process is based on optimizing the display of the content (attractive to users), and the design of the system has a basis for considering the speed of system access, even though it is done together by many users. The data display is performance in the form of graphics, images, and reports. The feature of conducting data analysis is interactive and massive. Notification features and the ability to interact with other systems.

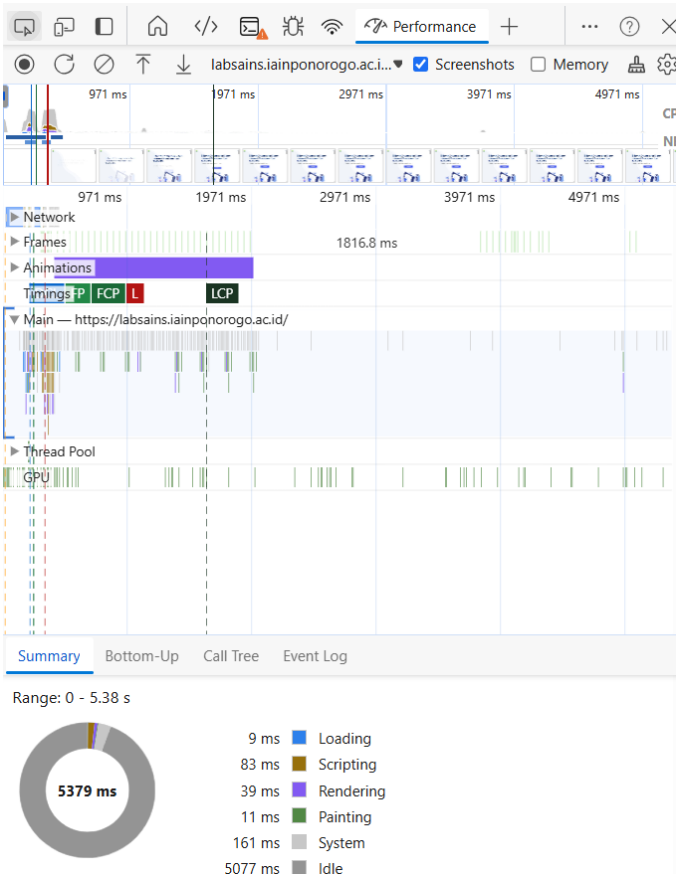

Figure 6. *Performance* "LabSains 1.0" Systems

5. Implementation and Operational Efficiency of "LabSains 1.0" System

The implementation of "LabSains 1.0" is the first pilot project to digitize science laboratories within IAIN Ponorogo. The application of the information system is a form of operational efficiency in the management of the laboratory. The following are the results of quantitative data related to the impact of the implementation of the management information system of the laboratory. The Students explained that using the management information system in a laboratory helps to overcome scheduling conflicts, errors in the provision of

reagents and laboratory equipment, and the stock of reagents can be managed in real time by the laboratory officer. Students argue that the quality of laboratory services runs more efficiently based on the management information system of the FTIK Laboratory. Students showed satisfaction with the use of the information system. On the other hand, there were several evaluations of the appearance of the system's interface and database. The appearance of the system interface can be made more attractive and aesthetically pleasing to improve user satisfaction. The massive development of information technology in higher education can encourage the achievement of aggregate efficiency at the university level.(Hidayat & Achjari, 2017)

Based on the theory of operational efficiency, this study focuses on three main indicators of efficiency. The primary indicator serves as a parameter of operational efficiency within the context of implementing the management information system in the laboratory at IAIN Ponorogo. The indicators examined include enhancing service quality, reducing errors in the organization, and increasing user satisfaction. (Dr. Gumgum Darmawan et al., 2023) Operational efficiency is an activity in improving service quality. The information system of the FTIK Laboratory is designed comprehensively that accommodate the constraints of scheduling laboratory use, recording laboratory inventory equipment, and recording the stock of reagents. The efficiency of the management of the information technology-based education corporation industry must be accompanied by the provision of adequate infrastructure, the improvement of human resource capabilities in the use of technology, and policy design to support the implementation of technology within the scope of educational organizations.(Febrianti et al., 2023) The efficiency of the management of the information technology-based education corporation industry must be accompanied by the provision of adequate infrastructure, the improvement of human resource capabilities in the use of technology, and policy design to support the implementation of technology within the scope of educational organizations.(Afrita, 2023)

Table 6. Percentage of Operational Efficiency

No	Statement	SS	S	TS	STS
	Improving the quality of service				
1	I can book a schedule easily through the app	*1*	*4*	*1*	*0*
2	I can easily submit a reagent request through the app	*0*	*5*	*1*	*0*
3	I can apply for a loan for lab equipment easily through the app	*0*	*5*	*1*	*0*
	Reduced errors in the organization				
4	I get an on-demand schedule in the app	*2*	*3*	*1*	*0*
5	I get in-app, on-demand reagents	*0*	*5*	*1*	*0*
6	I get on-demand lab tools in the app	*0*	*5*	*1*	*0*
	Increased user satisfaction				
7	I am satisfied with the app-based laboratory schedule booking service, because I do not experience schedule clashes	*1*	*4*	*0*	*1*
8	I am satisfied with the application-based science teaching lab equipment borrowing service, because the tools provided are of the correct type	*1*	*4*	*1*	*0*
9	I am satisfied with the service of providing application-based science lab reagents, because the reagents given are according to the type, and the quantity	*1*	*5*	*0*	*0*
	SUM	*6*	*40*	*7*	*1*
	Total x Score Weight	*24*	*120*	*14*	*1*
	Total Score			*159*	
	Maximum Score (4 Points x 6 respondents x 9 questions)			*216*	
	Percentage of Operational Efficiency			*74%*	

* Strongly Agree (SS) 4 points, Agree (S) 3 points, Disagree (TS) 2 points, Strongly Disagree (STS) 1 point

Based on the data, it is known that 86% of the students as practitioners strongly agree that scheduling arrangements for laboratory use are easier to do through filling out the E-Form on the system of FTIK Laboratory. E-form helps students to do laboratory activities. The students

agree that the submission of requests for reagents can be done easily and quickly through the management information system of the laboratory. Students strongly agree that the process of borrowing laboratory equipment can be done faster through online submission based on management information systems. Based on the results, the percentage of efficiency is 74%. The operational efficiency of use is moderate. The increase in percentage of efficiency can be increased through further development of the menu features of the LabScience 1.0 system. Advanced menu features that can be developed include the Reagent Material Safety Data Sheet (MSDS), and the Chat Room menu feature for laboratory managers. The Reagent Material Safety Data Sheet gives important information about hazardous reagents. The LabSains 1.0 information system can be an effective communicative tool in laboratory services through the Chat Room feature. The Chat Room feature has the function to speed up communication between officers and students in borrowing equipment or reporting reagent stock.

CONCLUSION

1. The “LabSains 1.0” system implementation has a significant impact on laboratory management in the FTIK laboratory IAIN Ponorogo. These organizing activities can provide benefits through an automated system that features comprehensive document processing capabilities. The "LabSains 1.0" information system has a scheduling menu and e-form for requesting materials, which accommodates student needs. The needs of laboratory officers are accommodated in the features of a database of users, a database of laboratory tools, a database of consumables, and a scheduling database. The valuable contribution of this technology is an integrated system in a laboratory administration that has been arranged based on user experiences.
2. This study focuses on three main indicators of operational efficiency related to the impact of the system. The indicators examined in this study pertain to system implementation, including enhancing service quality, reducing errors in the organization, and increasing user satisfaction. The results of the operational efficiency of using the “LabSains 1.0" system reach moderate level at 74% . The professional development and implementation of “LabSains 1.0" systems can significant effect in improving the quality of laboratory services.
3. Improvements and updates to the "LabSains 1.0" system must be carried out periodically to support the main functions of the system for users. Professional training for users, including laboratory officers, students, and lecturers, is the main factor in efforts to massively improve user capabilities.
4. The system has a great opportunity to continue to be developed through the addition of various features. The “LabSains 1.0” in the long term is expected to support superior university quality as well as KAN accreditation for laboratories, namely ISO 17025. (Hadi, 2018) (Subamia, 2024).

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