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User-Centered Design Optimization For Elementary School Teachers' Academic Administration Application

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ABSTRACT

This research raises problems from case studies of elementary schools which face problems regarding academic administration activities which make it difficult for teachers in their operational activities. The method used in this research is a user-centered design with two iterations. In the first iteration, researchers interviewed users to explore initial needs. Next, the researchers designed an application design in high-fidelity form. In both iterations of application design feedback from users used questionnaires and interviews. The results of this design allow users and application designers to reach agreements more quickly. However, the system usability scale research method is not sufficient for qualitative research. Therefore, interviews remain the appropriate method for evaluating the results of application design..

INTRODUCTION

In the era of the Independent Curriculum, the role of teachers is no longer limited to the teaching and learning process but also includes administrative responsibilities that support the continuity of learning activities. Although the Independent Curriculum aims to help students lag in their studies, many teachers are burdened by administrative tasks (A. Rosyada,2024).

Elementary school teachers at the Elementary School in Cibinong, Bogor, face similar problems. For additional information, the Elementary School in Cibinong, Bogor, has nine teachers, including the principal, who also teaches. Therefore, a solution is needed in the form of an academic administration application designed to support the effectiveness of teachers' work in handling administrative tasks. The quality of the application produced is a crucial factor in overcoming this problem. One indicator of application quality is its ease of use, which significantly impacts user satisfaction. This satisfaction, in turn, can positively impact individual users and the organization (The DeLone and McLean,2003). The ease of use of an application is determined by several aspects, namely: (1) ease of learning to use the application, (2) efficiency in operation, (3)

ease of users in remembering how to use it, (4) ability to avoid errors, and (5) intuitive and attractive interaction design (L. M. Hasani. And others, 2020).

Therefore, application quality can be evaluated through the user interface (UI) and user experience (UX) quality.

The proper development approach is needed to produce an application with optimal user interface (UI) and user experience (UX) quality. One practical approach is user-centered design (UCD), which emphasizes active user involvement in application development (L. M. Hasani. And others, 2020).

This approach meets user needs and expectations, producing an optimal user experience .Thus, optimizing the application of the user-centered design (UCD) method is an essential step in producing academic administration applications that are functional, easy to use, and attractive to users. However, to ensure a quality user interface (UI) and user experience (UX), the right tools are needed to assess the results of the UI and UX designs. One of the tools to evaluate the results of UI and UX designs is the USE Questionnaire, with one example in the study of UI and UX design for AI education in school children . However, in the literature study on user-centered design (UCD), the most widely used testing tool is the System Usability Scale (SUS) score (L. M. Hasani. And others, 2020). Based on these references and the case study conditions, the System Usability Scale (SUS) score is the measuring tool used.

The System Usability Scale (SUS) is a usability evaluation instrument first introduced by John Brooke in 1986. The System Usability Scale (SUS) was designed as a quick and straightforward tool to measure the usability of technology-based systems, including software interfaces, mobile applications, and hardware. The System Usability Scale (SUS) is widely used because it provides in-depth insights into product usability without requiring much time and resources (J. Brooke and others,1996). The System Usability Scale (SUS) consists of 10 statements covering aspects of usability and learnability. The following table contains 10 questions converted into Indonesian (Z. Sharfina and H. B. Santoso,2016) . Each statement is assessed using a 5-point Likert scale, ranging from "strongly disagree" to "strongly agree." The System Usability Scale (SUS) produces a final score ranging from 0 to 100, which provides a quantitative assessment of the usability of a system. Usability is an aspect that measures how easy it is to use a user interface intuitively. Meanwhile, learnability is an aspect that measures how quickly users understand how to use the system. The System Usability Scale (SUS) has several advantages and disadvantages. The benefits of the system usability scale (SUS) are: (1) the simplicity of SUS is easy to understand and use by participants and evaluators, (2) the generalization of SUS is easy to apply to various types of systems, and (3) quantitative assessment of the system usability scale (SUS) score because it provides numerical results that facilitate comparison between products with iterations during the design process. The disadvantages of the system usability scale (SUS) are: (1) the existence of subjective interpretation because the assessment of the system usability scale (SUS) score is influenced by the user's view, and (2) not in-depth because the system usability scale (SUS) only provides a general description of usability, without specific details about interface problems or user experience. The System Usability Scale (SUS) is a handy tool

for evaluating technology-based systems' usability and user experience. Its simplicity allows SUS to effectively compare multiple design iterations while providing quantitative insights into aspects that need improvement in UI/UX design. In addition, the SUS score range and interpretation, such as a value of 0 - 50 is inferior, a value of 50 - 70 is sufficient, a value of 70 - 85 is good, and a value of 85 - 100 is excellent (A. Bangor and others,2008)

Several previous studies support this research. The first related study is a study that conducted a systematic literature review on the application of User-Centered Design (UCD) in developing user interfaces (UI) for e-learning systems. The review included 17 articles between 2015 and early 2020, focusing on the methods used in UCD and their impact on system usability. The study found the most frequently used methods were questionnaires, interviews, high-fidelity prototyping, and usability testing. User involvement in various design stages has been shown to produce User Interfaces (UI) with better usability. The study suggests the involvement of end users and subject matter experts in the design process to ensure an effective User Interface (UI) that supports the learning process (L. M. Hasani. And others, 2020)

The second study, redesigning maternal and child health applications in Indonesia (Mobile KIA), used the user-centered design (UCD) approach. This study was conducted in three iterations, involving health workers, health experts, and pregnant women as respondents. The application is designed to improve the user experience by implementing Shneiderman's 8 Golden Rules. The final result is a high-fidelity application prototype that includes health recording, education, reminders, blood supplement tablet consumption tracking, and fetal development monitoring. Evaluation using the system usability scale (SUS) resulted in a final score of 85.4, which is categorized as "excellent" (A. F. Adidharma and other,2024)

The third study describes the application of the user-centered design (UCD) approach to redesigning the user interface of artificial intelligence-based educational software, Blockly–Electron, which is intended for elementary and secondary school students. This study identifies the relationship between four dimensions of usability: Usefulness, Ease of Learning, Ease of Use, and Satisfaction. Ease of Use was found to be a mediating variable that influences user satisfaction. This study produces a high-fidelity prototype through design iterations based on user feedback, contributing to the development of a structured User-Centered Design (UCD) design methodology for Artificial Intelligence (AI) educational software (C. Cen *et al,2023)*

The Fourth: A study on evaluating and improving the usability of the Maxim application, a ride-hailing service in Indonesia, through the User-Centered Design (UCD) approach. The focus is on identifying user problems, developing alternative design solutions, and evaluating improvements in application usability (R. D. Saksono and other,2024)

The study aims to overcome teachers' administrative burden in significant case studies, thereby reducing the focus on being a learning facilitator, which is the basis for the needs of academic administration applications. Therefore, proper development is needed to produce the application's user interface (UI) and user experience (UX) based on user needs, so that

administrative obligations are still carried out while reducing the administrative burden of these obligations.

METHOD

This qualitative research method uses interviews and questionnaires to explore problems and get feedback from application users. Furthermore, application design uses the user-centered customer method, using high-fidelity design in two iterations. Figure 1 shows the research method that will be carried out. The questionnaire in Table 1 is filled out using the interpreted SUS Score range.

Table 1 Questionnaire of System Usability Scale (SUS)

No	Questions	Inferior (1)	Sufficient (2)	Good (3)	Excellent (4)
1	I think I will use this system again.				
2	I find this system complicated to use.				
3	I found this system easy to use.				
4	I need help from another person or technician in using this system.				
5	I feel like the features of this system work as they should.				
6	I feel like there are a lot of things that are inconsistent (not harmonious) with this system.				
7	I feel like other people will understand how to use this system quickly.				
8	I find this system confusing.				
9	I feel there are no barriers in using this system.				
10	I need to get used to it first before use this system.				

The First Iteration started when the researcher conducted the first interview at the Elementary School in Cibinong, Bogor, to explore the problems and needs of teachers regarding academic administration applications using the semi-structured interview method with the theme of educational administration. The interview results will be used as initial needs in designing elementary school academic applications. After exploring the needs, the researcher conducted a high-fidelity design. After completing the high-fidelity design, the next step is to test the user by filling out the SUS assessment questionnaire, which can be seen in Table 1. However, the researcher will continue filling out the questionnaire by conducting a semi-structured interview to explore user information. Furthermore, the results of the questionnaire and follow-up interviews become the results of feedback from the design results in the first Iteration.

The Second Iteration started when the researcher analyzed the feedback results from the first Iteration. After getting the feedback results from the first Iteration, the researcher conducted a high-fidelity design. After completing the high-fidelity design, the next step is to test the user by asking them to fill out the SUS assessment questionnaire, as seen in Table 1. However, the researcher will continue filling out the questionnaire by conducting a semi-structured interview to explore user information.

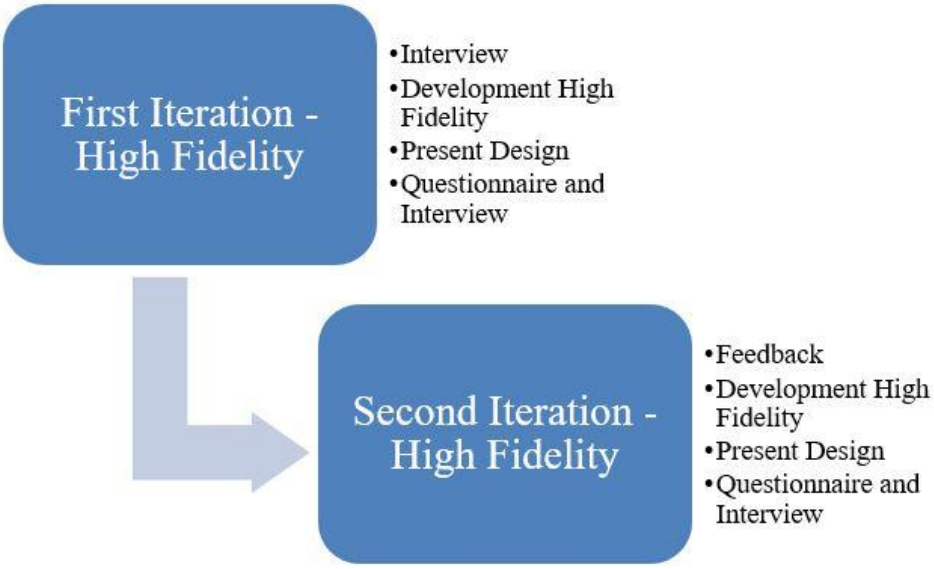


Figure 1 Method of This Research

RESULT AND DISCUSSION

The research results start from the first interview, the formulation of application needs, and the design development for the first iteration. After the first iteration, design results are completed, an evaluation will be conducted by filling out a questionnaire and interviewing application users. After getting input from the first iteration design, the next step is to formulate needs from the design results and input, then design and evaluate for the second and third iterations, after completing the three iterations of design or development, namely conducting a discussion of the research results and especially the role of user-centered design in the design process. We interviewed three respondents: one school principal and two teaching teachers. The interviews consisted of two sessions: the first with the school teachers and the second with the school principal.

Based on the interview results, the application needs can be formulated into two parts: administration by the Principal and teaching by teachers. The application needs are formulated into a process flow divided into three parts: master data management for the principal user, activities for the principal user, and learning activities for the school teacher user. The first process flow is master data, divided into three activities: study plan management, financing plan management, and non-academic activity plan management. For study plan management, input, update, and delete are used. For feedback and updates, starting from selecting subjects, selecting class levels, selecting study periods, and inputting achievements, which are divided into achievements in one

semester, per month, and per week in each month. For financing management, namely submitting funds by multiplying parameters by the number of active students, then inputting a list of financing details, and for non-academic activity plan management, namely inputting a list of activities and students involved in the activity plan. Figure 2 is the master data process flow carried out by the school principal.

The second process flow is the learning activity for administration, which is divided into four activities: learning activities, learning reports, financing realization, and financing reports. For learning activities, select a list of classes and available subjects, and display the details of the information. After that, you can take attendance on the student list and fill in student achievements for the course. For learning reports, namely by determining the period to display data presented in graphical form, it can be downloaded as an Excel file. For financing realization, namely by inputting financing realization data along with photos. For financing reports, determining the period to display data presented in graphical form can be downloaded as an Excel file. Figure 3 is the process flow of learning activities carried out by the school principal.

The third process flow is learning activities for teachers, consisting of learning activities and reports. For learning activities, select a list of classes and available subjects, and display the details of the information. After that, you can take attendance on the student list and fill in student achievements for the course. For learning reports, namely by determining the period to display data presented in graphical form, it can be downloaded as an Excel file. Figure 4 is the process flow of learning activities carried out by the school principal.

The application design results are made in high fidelity based on the process flow from the formulation results. The first process flow is master data, which is divided into three activities: study plan management, financing plan management, and non-academic activity plan management. The second process flow concerns learning activities from the administration or principal side. The third process flow concerns learning activities from the school teacher's side.

The application design results are made in high fidelity based on the process flow from the formulation results. The first process flow is master data, divided into three activities: study plan management, financing plan management, and non-academic activity plan management. Figure 5 is an example of the results of the study plan design. The second process flow is about learning activities from the administration or principal. Figure 6 is the result of the learning activity design from the administration or principal side. The third process flow is about learning activities from the school teacher's side. Figure 7 is the result of the learning activity design from the school teacher's side.

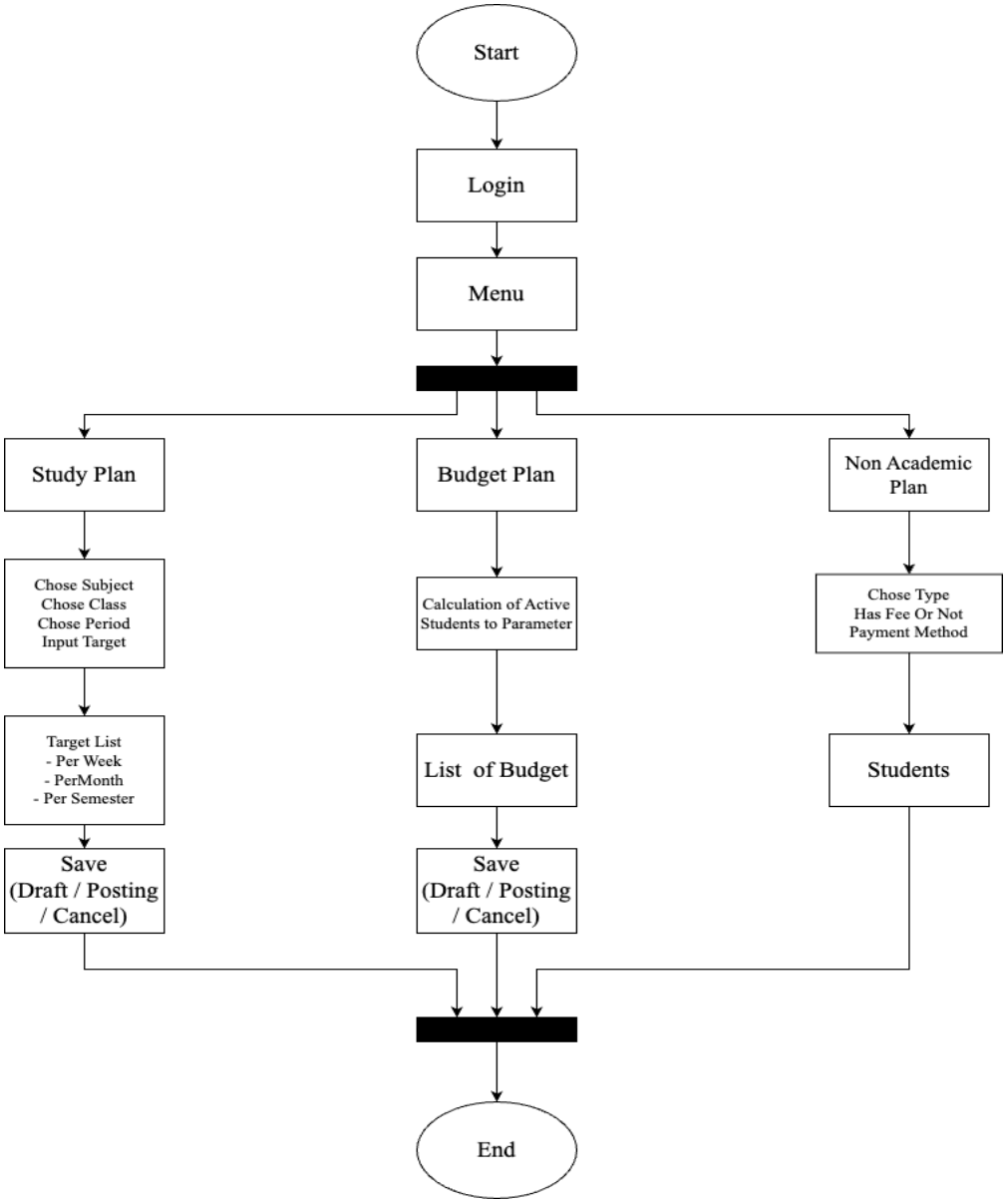


Figure 1: The learning process flows from the administration side.

The next step is evaluating the application design results. The evaluation was carried out on three (3) respondents, consisting of one (1) principal and two (2) teachers. The review was done by presenting the design results via the Zoom application. The design presentation was carried out on both designs, namely the application for the admin or principal in the form of a web application design and the application design for teachers in the form of a mobile application.

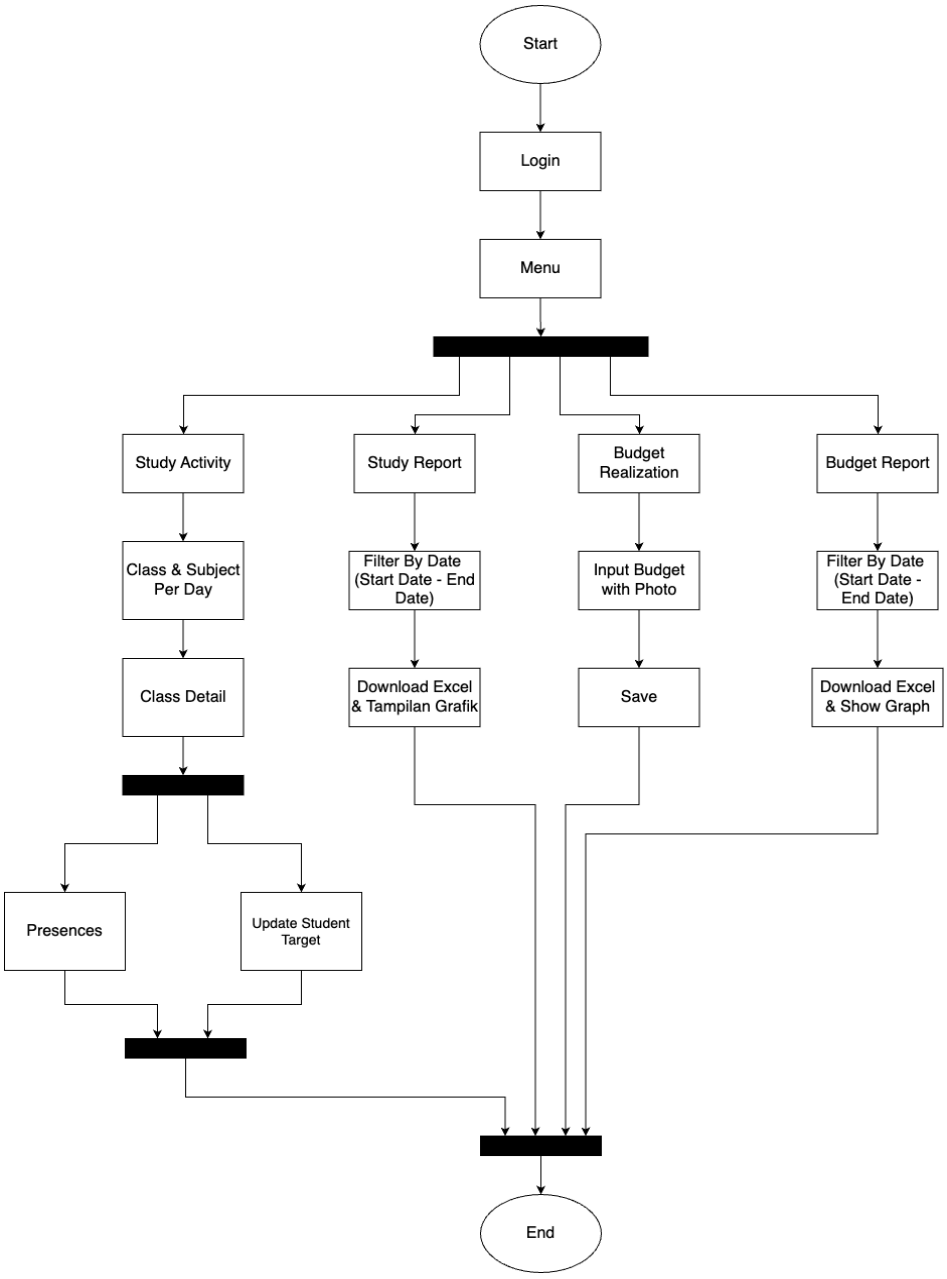


Figure 2: The learning process flows from the administration side.

The role of financial literacy can prepare students to be more competitive. Besides that, financial literacy has a fundamental role in managing the finances of Accounting Study Program Vocational School students. Therefore, it is recommended that the financial education curriculum be strengthened and better integrated into learning to improve overall financial literacy.

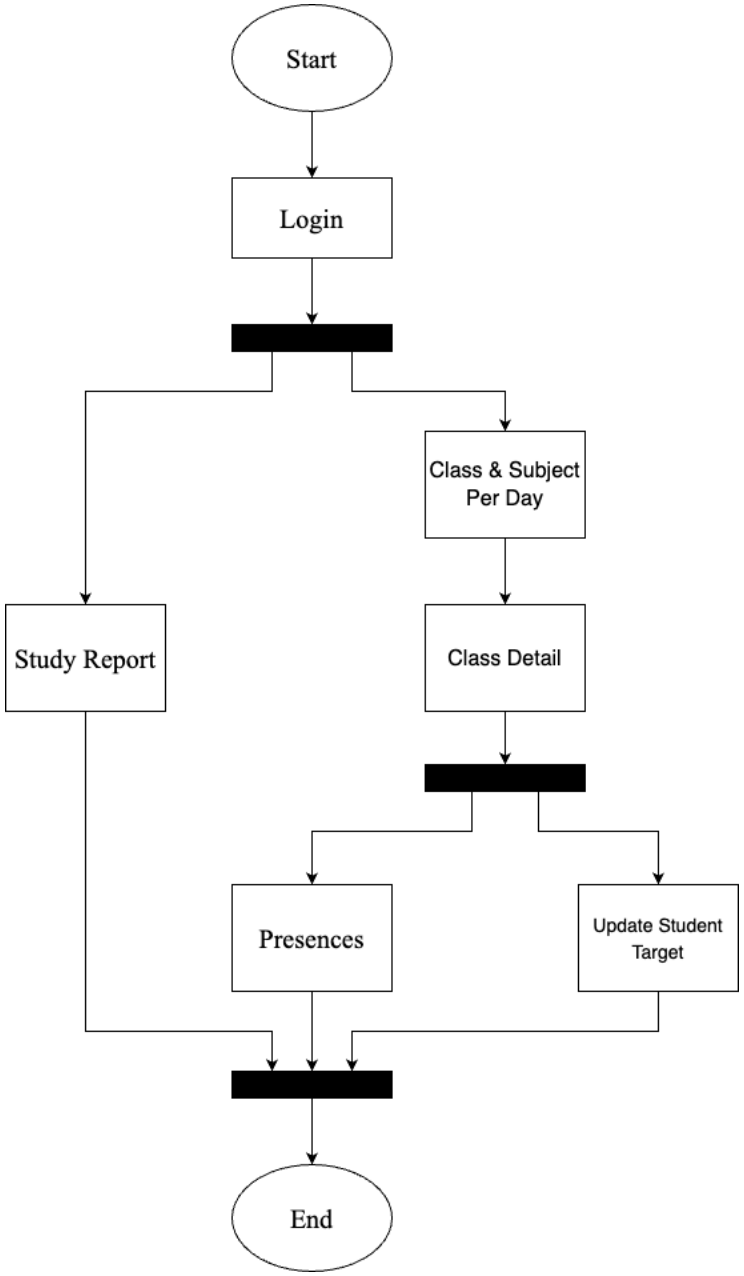


Figure 3: The learning process flows from the school teacher's side.

The first evaluation result was an interview with the three respondents. However, it is necessary to emphasize that the application must be connected to the applications they have been using, such as LKHP and E-Rapor, to achieve the goal of the application design that provides efficiency and effectiveness in learning administration. The second evaluation result was completing a questionnaire for the three respondents. The questionnaire aimed to assess the application's ease of use based on the design results. Based on the average value of the ten questionnaire questions, users can understand the application design, but still need time to adapt and face difficulties in using it. Table 2 shows the results of the questionnaires of the three respondents.

After conducting the first iteration, from interviews to exploring initial needs to the evaluation stage of the design results, the next step is to perform the second iteration.

The second iteration starts from the formulation of needs taken from the results of the first iteration evaluation. Based on the results of the first evaluation, the initial iteration design has generally made it easy for users to understand the application. However, users emphasized that the application design needs to be integrated with the applications they already use, such as LKHP and E-Raport. Therefore, the design focuses on integrating the two applications in this second iteration.

Based on the results of the needs formulation in this second iteration, the design focuses on integration with the LKHP and E-Raport applications. Therefore, the design focuses on mobile applications for teachers by presenting information that the contents of learning activities will be integrated with the two applications. Figure 5 is the result of the design that focuses on integration with the LKHP and E-Raport applications.

Table 2: The Results of The Questionnaires of The Three Respondents

No	Questions	First Responden	Second Responden	Third Responden	Average
1	I think I will use this system again.	3	3	3	3
2	I find this system complicated to use.	3	3	2	2.67
3	I found this system easy to use.	3	3	2	2.67
4	I need help from another person or technician in using this system.	2	3	4	3
5	I feel like the features of this system work as they should.	3	3	2	2.67
6	I feel like there are a lot of things that are inconsistent (not harmonious) with this system.	3	3	3	3
7	I feel like other people will understand how to use this system quickly.	3	4	2	3
8	I find this system confusing.	1	3	2	2
9	I feel there are no barriers in using this system.	3	3	3	3
10	I need to get used to it first before use this system.	3	4	3	3.33

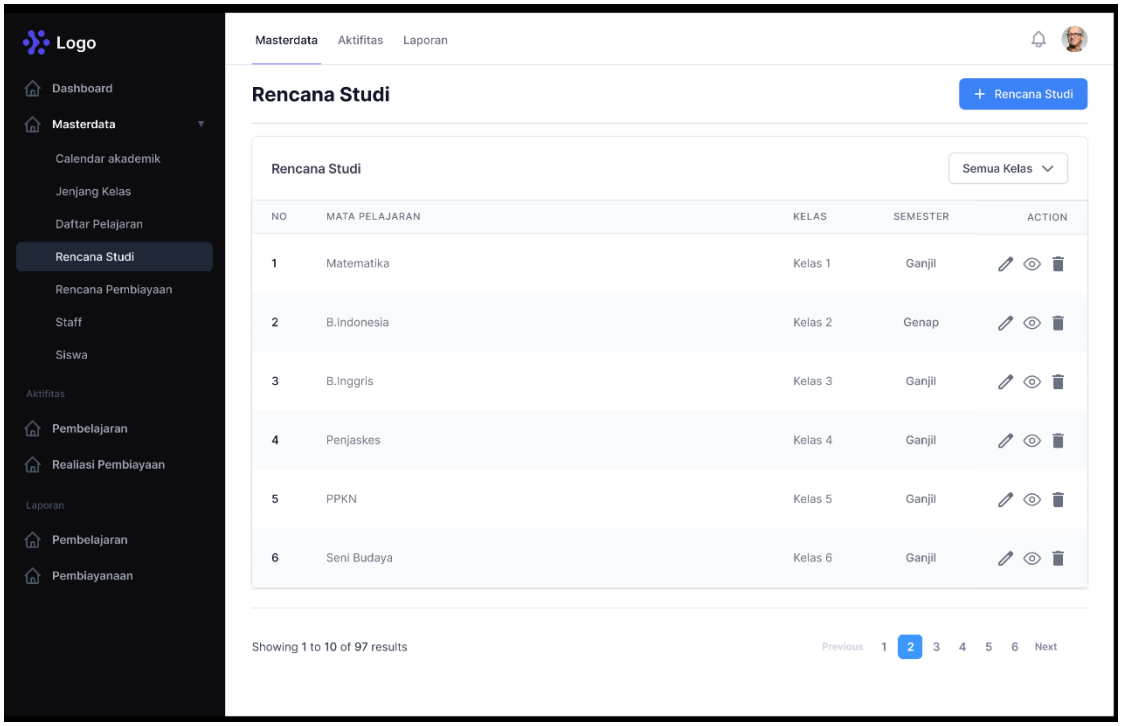
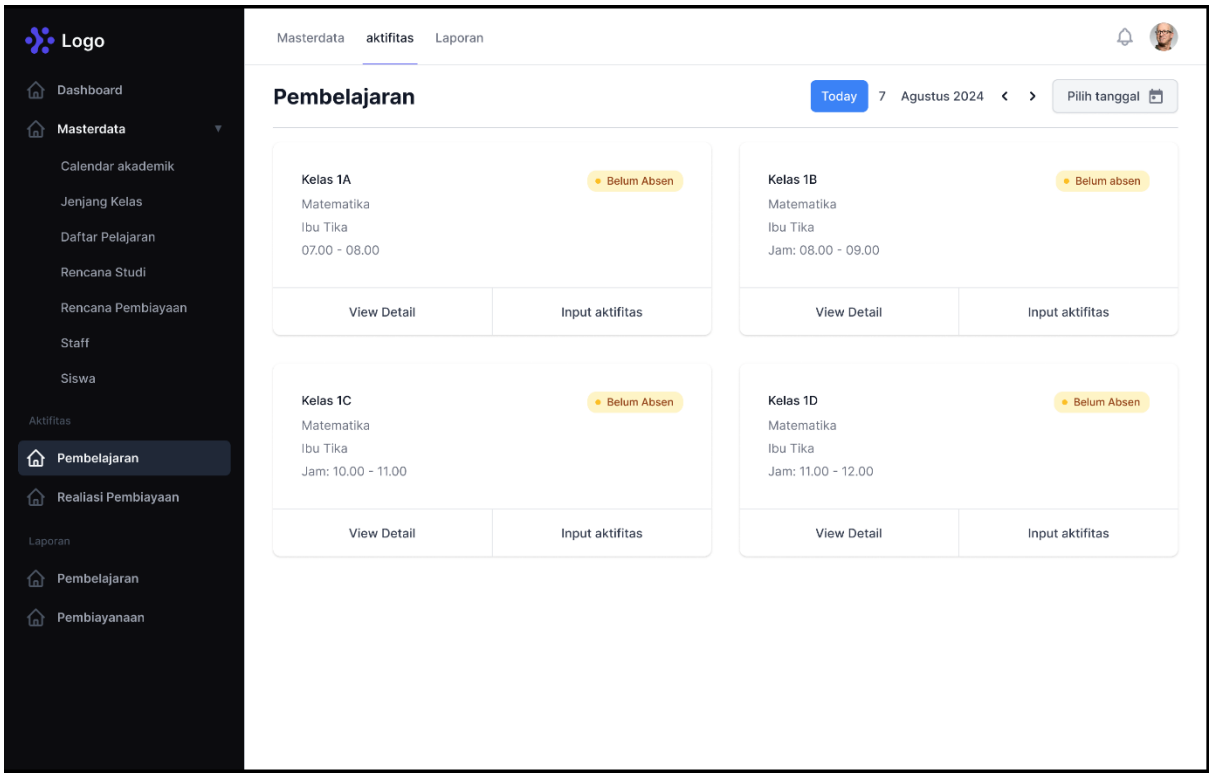


Figure 4: An Example of The Results of The Study Plan Design

The next step is to evaluate the results of the application design. The evaluation was carried out on two respondents and two teachers. The review provides the results of the mobile application design via a link to the user. The goal is for them to use the

application design independently and fill out the questionnaire to get feedback. Based on the average value of the ten questionnaire questions, users understand the application



better based on the second iteration design results, and the difficulty in understanding the application is reduced. The evaluation results in the second iteration can be seen in Table 3.

Figure 5: The Result of The Learning Activity Design From The Administration or Principal Side

Based on two iterations conducted by researchers, it was found that application design is subject to individual users. However, application designers need to explore the needs of various users to determine the application's needs. In addition, high fidelity makes it easier for users to capture the results of application design to express their needs and difficulties. In addition, high-fidelity design does not take up time, money, and energy compared to making applications, even in the form of minimum viable products (MVP).

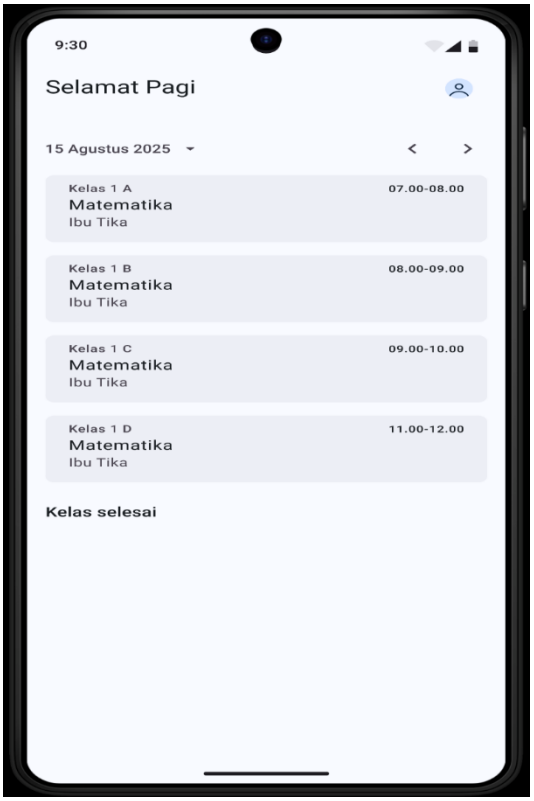


Figure 6 : The Result of The Learning Activity Design From The School Teacher's Side

The design needs to be assessed carefully. If the number of respondents is less than 30, the minimum number based on Kerlinger and Lee in 2000, using only the SUS method, will not be optimal. Therefore, combining the questionnaire with further interviews is necessary to explore user views on the design results.

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Table 1 : The Evaluation Results in The Second Iteration

No	Questions	First Responden	Second Responden	Average
1	I think I will use this system again.	3	3	3
2	I find this system complicated to use.	2	3	2.5
3	I found this system easy to use.	3	3	3
4	I need help from another person or technician in using this system.	3	3	3
5	I feel like the features of this system work as they should.	3	3	3
6	I feel like there are a lot of things that are inconsistent (not harmonious) with this system.	3	3	3
7	I feel like other people will understand how to use this system quickly.	3	3	3
8	I find this system confusing.	3	3	3
9	I feel there are no barriers in using this system.	3	3	3
10	I need to get used to it first before use this system.	3	3	3

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