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IMPLEMENTATION OF DESIGN THINKING METHOD AND USABILITY TESTING IN THE DESIGN OF A SCHOLARSHIP INFORMATION SYSTEM

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ABSTRAK

Program Beasiswa Alumni SMA Negeri 1 Singaraja merupakan wujud nyata kepedulian lembaga dalam meningkatkan mutu pendidikan. Namun, proses seleksinya masih dilakukan secara konvensional yaitu menggunakan WhatsApp untuk penyebaran informasi, pengumpulan berkas hardcopy, dan pengecekan manual. Hal ini mengakibatkan keterlambatan dan penumpukan arsip. Penelitian ini bertujuan merancang sistem informasi beasiswa untuk membuat proses seleksi lebih mudah, praktis, dan cepat, menggunakan metode Design Thinking. Terdapat lima tahapan yang dilakukan. Tahapan pertama yaitu empathize, menghasilkan empathy map. Tahapan kedua yaitu define, menghasilkan user persona, point of view, dan pain points. Tahap ketiga yaitu ideate menghasilkan how-might we, prioritization idea, information architecture, dan user flow. Tahapan keempat yaitu prototype menghasilkan desain prototype sistem. Tahap kelima yaitu pengujian prototype desain menggunakan usability testing untuk mengukur aspek efektivitas, efisiensi, learnability, error dan kepuasan pengguna. Pengujian dilakukan dua kali, dimana pengujian kedua dilakukan setelah revisi desain berdasarkan hasil pengujian pertama. Hasil pengujian menunjukkan aspek efektivitas meningkat pada siswa sebesar 17%, guru sebesar 2%, dan staf sebesar 16%. Aspek efisiensi meningkat pada siswa (0,14 goals/sec), guru (0,03 goals/sec), dan staf (0,04 goals/sec). Aspek learnability meningkat pada siswa sebesar 15%, staf sebesar 2%, sedangkan guru mengalami penurunan sebesar 5%. Aspek error turun menjadi 0 yang menunjukkan tidak ada kesalahan yang dilakukan saat pengujian oleh ketiga kelompok pengguna. Aspek kepuasan meningkat sebesar 4 poin, sehingga desain Sistem Informasi Beasiswa dikatakan acceptable dengan rating best imaginable dan peringkat A.

Kata kunci: *sistem informasi beasiswa, design thinking, usability testing*

ABSTRACT

The SMA Negeri 1 Singaraja Alumni Scholarship Program is a tangible demonstration of the institution's commitment to enhancing educational quality. However, the selection process is still conducted conventionally, using WhatsApp for information dissemination, collecting hardcopy documents, and manual checking, which leads to delays and file accumulation. This research aims to design a scholarship information system to make the selection process easier, more practical, and faster, using the Design Thinking method. The process involves five stages. The first stage, empathize, produces an empathy map. The second stage, define, results in a user persona, point of view, and pain points. The third stage, ideate, generates how-might-we questions, prioritization ideas, information architecture, and user flow. The fourth stage, prototype, results in the system prototype design. The fifth stage involves testing the prototype design using usability testing to measure effectiveness, efficiency, learnability, error, and user satisfaction. Tests were conducted twice, with a second test being conducted after a design revision based on the results of the first test. Test results showed that the effectiveness aspect increased in students by 17%, teachers by 2%, and staff by 16%. Efficiency aspects improved in students (0,14 goals/sec), teachers (0,03 goals/sec), and staff (0,04 goals/sec). The learnability aspect improved among students by 15%, staff by 2% while teachers experienced a 5% decrease. Error aspects dropped to 0 indicating that no mistakes were made during testing by three groups of users. The satisfaction aspect increased by 4 points, so the scholarship information system design is said to be acceptable with the best imaginable rating and rank A.

Keywords : scholarship information system, design thinking, usability testing

1. INTRODUCTION

Public and private educational institutions, including elementary schools, junior high schools, senior high schools, and universities, generally have scholarship programs. Scholarship programs are one form of concern from educational institutions for students to improve their achievements in academic and non-academic fields. Law No. 20 of 2003 concerning the National Education System, Chapter V, Article 2 paragraph 1 (c), states that every student in every educational unit is entitled to scholarships for those who are high achievers whose parents are unable to finance their education [1]. As one of the formal educational institutions under the supervision of the Buleleng District Education Department, SMAN 1 Singaraja has a scholarship program, one of which is the Alumni Scholarship.

The scholarship process for alumni conducted at SMA Negeri 1 Singaraja is still carried out conventionally, such as disseminating information directly in classrooms, announcements on information boards, or through WhatsApp groups, collecting files in hardcopy, and manually processing data. This causes issues such as the accumulation of physical scholarship archives that continue to grow. Based on interviews conducted with students, teachers, and staff of SMA Negeri 1 Singaraja, the Alumni Scholarship selection process has not yet implemented an information system and is still done manually. Therefore, there is a need to improve facilities by using alternative digital media such as an easily accessible information system. The conclusion from this statement is that SMA Negeri 1 Singaraja needs an information system that can support the scholarship process, making it easier, more practical, and faster.

Based on the issues described, this research provides a solution by designing a web-based scholarship information system. This scholarship information system will be one of the additional features on the school's existing website. Designing an information system is important because before a system is built, the first step is to design the system, which is done to analyze user needs [2]. This research uses the Design Thinking method for system design because the main goal of this method is to prioritize empathy for the desires, needs, and challenges of end users to fully understand the problem with the hope of developing a more comprehensive and effective solution [3]. The design thinking method consists of five stages, such as empathize, define, ideate, prototype, and test [4]. Testing is conducted using the Usability Testing method to evaluate the design results to get feedback from potential users. In this study, the testing focuses on five aspects, namely effectiveness, efficiency, learnability, errors, and user satisfaction. The aspects of effectiveness, efficiency, learnability, and errors are measured using performance measurement techniques. User satisfaction is measured using the think-aloud technique and the Usability Metric for User Experience (UMUX) questionnaire.

Previous research related to the implementation of the design thinking method was conducted by [5] to design the user interface and user experience on the E-learning Information System. The system design was carried out through the five stages of design thinking, and the prototype testing was done using the usability testing method, which included task scenarios as well as the System Usability Scale (SUS) and User Experience Questionnaire (UEQ) questionnaires. Usability testing was conducted to measure aspects of learnability, efficiency, and satisfaction. The results showed that the e-learning prototype design provided a good user experience. Research [6] also applied the design thinking method in designing the UI/UX of an ineffable psychological counseling mobile application. Testing was conducted using the Cognitive Walkthrough method with the help of the Maze tool. Overall, the test results showed that the design prototype was easy to use, easy to understand, effective, and the interface design could be implemented. In research [7], usability evaluation was conducted on the Simalu application using the usability testing method with the Retrospective Think Aloud technique and Performance Measurement. The results showed that the Simalu application did not yet have effective, efficient quality and did not meet user satisfaction, so design improvements were also made to make the application better meet user expectations.Meanwhile, research [8] conducted a usability analysis on the Blanjo application using two methods, namely the Post-Study System Usability Questionnaire (PSSUQ) and the Usability Metric For User Experience (UMUX). The overall PSSUQ score was in the Lower Limit range. Meanwhile, the average score using the UMUX method was in the "Marginal High" range with a grade of "D" and an adjective rating of "good".

Some aspects that differentiate this research from previous research are that this research designs a scholarship information system using the Design Thinking method followed by prototype testing. The system prototype testing process is conducted twice, with the second test performed after design improvements based on respondents' recommendations from the first test. Five aspects are tested, including effectiveness, efficiency, learnability, errors, and satisfaction, using performance measurement techniques, think aloud, and the UMUX questionnaire.

2. METODE

This research uses design thinking methods in the design of scholarship information systems. According to [9], the advantages of design thinking are approaches that are seen as methods, thinking, or working tools that are capable of connecting an organization with the people it serves, transforming existing data into executable ideas, looking at new opportunities, helping to increase the speed and effectiveness of creating new solutions, prioritizing people and behavior as the center of activity, encouraging optimism, and emphasizing participation and collaboration. Design thinking methods focus not only on what is seen and felt, but also on the user experience. The application of design thinking methods can be done repeatedly, from the stages and process of development to obtaining the right solution and design [10]. The design phases of Thinking can be seen in Figure 1.

Figure 1. Research Flow

Based on Figure 1, the planning phases can be described as follows:

A. Empathize

The empathy stage is an early stage that is carried out to identify user problems and user expectations for system development. At this stage, problems and solutions are obtained through interviews, observations, and questions. Then interviews are conducted with potential users to identify their problems and expectations. The results of interviews with three potential users, namely students, teachers, and staff, then generate an empathy map.

B. Define

The definition phase is the process of gathering user opinions and understanding user needs, which is used as a basic foundation in the design of a system prototype. User persona is a characteristic of the target user that aims to know the problems and expectations of the use of the product later. Point of view is made based on the user persona by making more specific related target users used as a guide in the process of making system design [11]. Pain points are special problems that are faced by users in various aspects, with the aim of minimizing user difficulties so as to increase satisfaction when using the system [12].

C. Ideate

The ideate phase is the phase by which ideas are gathered into solutions that are used to solve problems that have been found in the empathize and define phase. How-might we are short questions that help to get ideas and also solutions by doing brainstorming [12]. Prioritization of ideas is the process of prioritizing existing ideas into four groups: do it now, do next, do last, and do later. Information architecture is a collection of designs for labeling, setting, searching, and navigation systems within a website or application. User flow is an overview of the flow of a system that has been designed.

D. Prototype

The prototype phase is a phase in the design of a high-fidelity prototype system that is used as a simulation of a product using the Figma software with an interactive prototype display that approaches the visual representation of an actual object that has colors, layouts, sizes, elements, hierarchies of information, and other interactions.

E. First Test

The test phase is a phase of testing on prototype design using the Usability Testing method with Performance Measurement and Think Aloud techniques as well as a Usability Metric for User Experience (UMUX) questionnaire. Performance measurement is used in testing to obtain quantitative data related to what respondents have done during the completion of task scenarios, taking into account four aspects, namely effectiveness, efficiency, learnability, and error [13]. Think Aloud is a test involving users or end users continuously verbalizing to express thoughts, feelings, and opinions when interacting with the system [14]. The Usability Metric for User Experience (UMUX) questionnaire is a broader type of single-ease question but shorter than the System Usability Scale, which uses a 7-point Likert scale with 4 question points [15].

F. Design Revision

After obtaining the results of the first test evaluation, revisions were made to the prototype design. This design revision refers to every problem encountered during the testing process and also refers to the results of the think aloud that was carried out on the first test respondents. The updated design aims to address these issues, ensuring a more user-friendly experience. Further testing will be conducted to validate the effectiveness of these changes.

G. Second Test

The second test was carried out again to evaluate the design revisions that had been made. The testing technique and respondents in the second test are the same as the first test. Then the results of the second test will be compared with the first test to see whether there is an increase or decrease in user understanding of the system workflow based on the revised prototype design.

3. RESULT AND DISCUSSION

This section presents the results of each stage of design thinking from empathize, define, ideate, prototype, first test, design revision, to second test.

A. Empathize

The empathize phase is conducted to understand user issues related to the current scholarship process and provide solutions by making scholarship design plans. After conducting interviews with one student, one teacher, and one staff from SMA Negeri 1 Singaraja, the results of the interviews are then analyzed and carried out in the empathy map. Empathy Map aims to know the needs of the user based on four quadrants such as says, thinks, does, and feels. There are three identified user groups namely students, teachers, and staff. Figure 2 shows one example of an empathy map of a student user group.

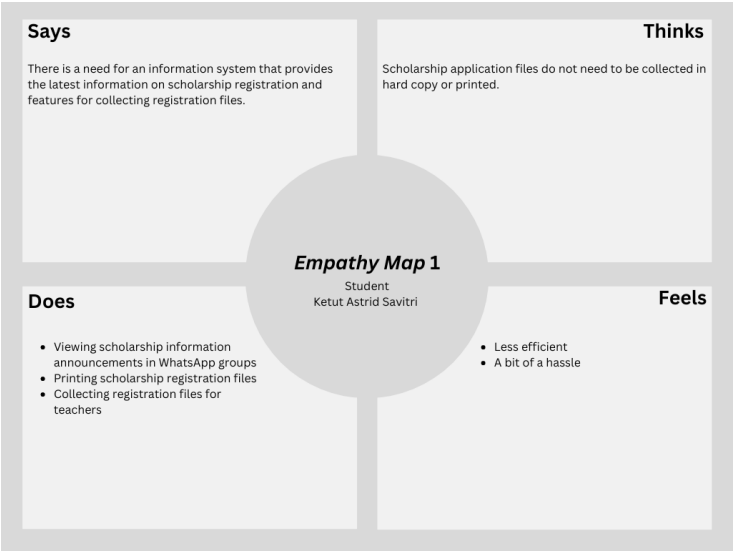

Figure 1. Student Empathy Map

B. Define

The definition phase is used to analyze and understand the results of the previous phase of empathizing by generating user personas, points of view, and pain points based on the empathy map that has been created.

a) User Persona

User persona is an overview of the characteristics of the target user with the aim of identifying the problems and expectations of a target group of users in using the product to be designed. The study described three user-persons for each user group, namely students, teachers, and staff. Figure 3 shows one example of a user persona in a student user group.

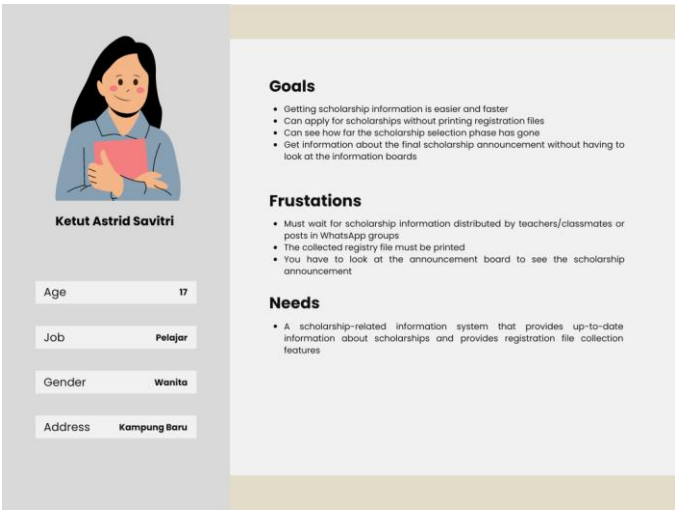

Figure 2. Student's User Persona

b) Point of View

Point of view is based on the user persona at the previous stage, but is more specifically related to the needs and insights of the target user. Table 1 shows the results of the point of view.

Table 1. Point of view result

User	Need	Insight
Students	A scholarship-related information system that provides up-to-date information about scholarships and provides registration file collection features.	Users feel it will be more effective and efficient to find up-to-date information about scholarship registration as well as collect registration files.
Teachers	A system that provides services for the scholarship process.	Users felt it would be easier to do the scholarship process.
Staff	A platform that can provide information about scholarships.	Users feel they'll be more efficient in providing information about scholarships.

c) Pain Points

Pain points are specific problems faced by users in various aspects with the aim of minimizing user difficulties so that they can increase satisfaction when using the system. Figure 4 shows the result of pain points.

Figure 3. Pain Points Result

C. Ideate

The ideation stage carries out the gathering of ideas to generate solutions to the problems found by creating how-might we, prioritization ideas, information architecture, and user flow used to create prototype design scholarships information system.

a) How-Might We

The how-might phase we aim to investigate more aspects of a particular problem so that it can be found a problem suitable for the process of searching for ideas and solutions later. Figure 5 shows the results of how-might we.

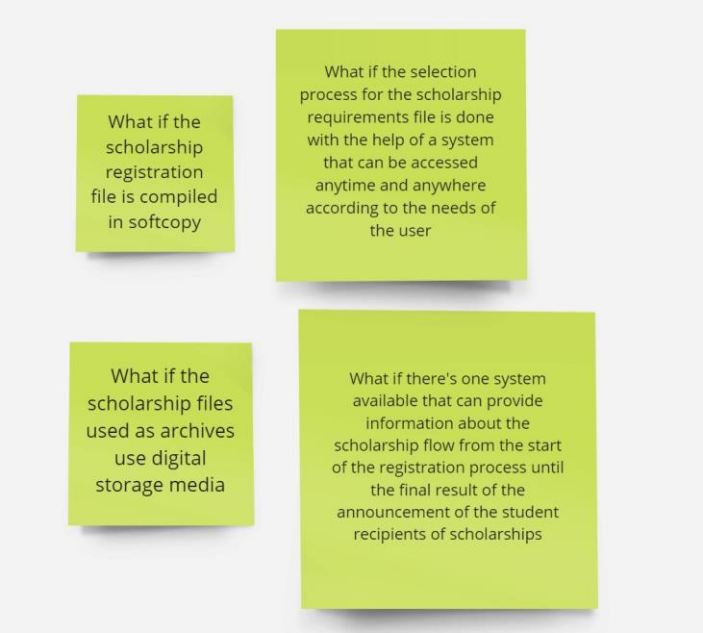

Figure 4. How-Might We Result

b) Prioritization Idea

Prioritization ideas are used to prioritize existing ideas into several groups. Figure 6 shows the result of the prioritization of ideas.

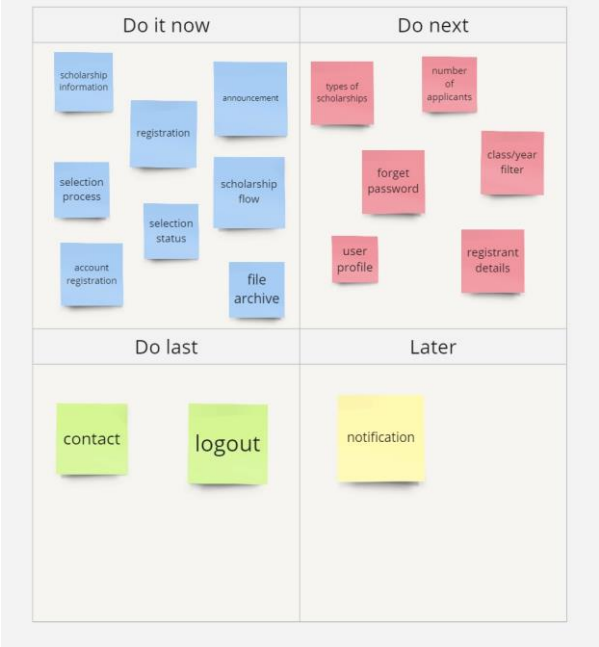

Figure 5. Prioritization Idea Result

c) Information Architecture

Information architecture is information presented in the form of graphs, columns or structured designs that are interrelated so that they can be easily understood. It can also be defined as a set of designs such as labels, settings, searches and navigation systems within a website or application. Figure 7 displays one of the scholarship information architecture schemes on a group of staff users.

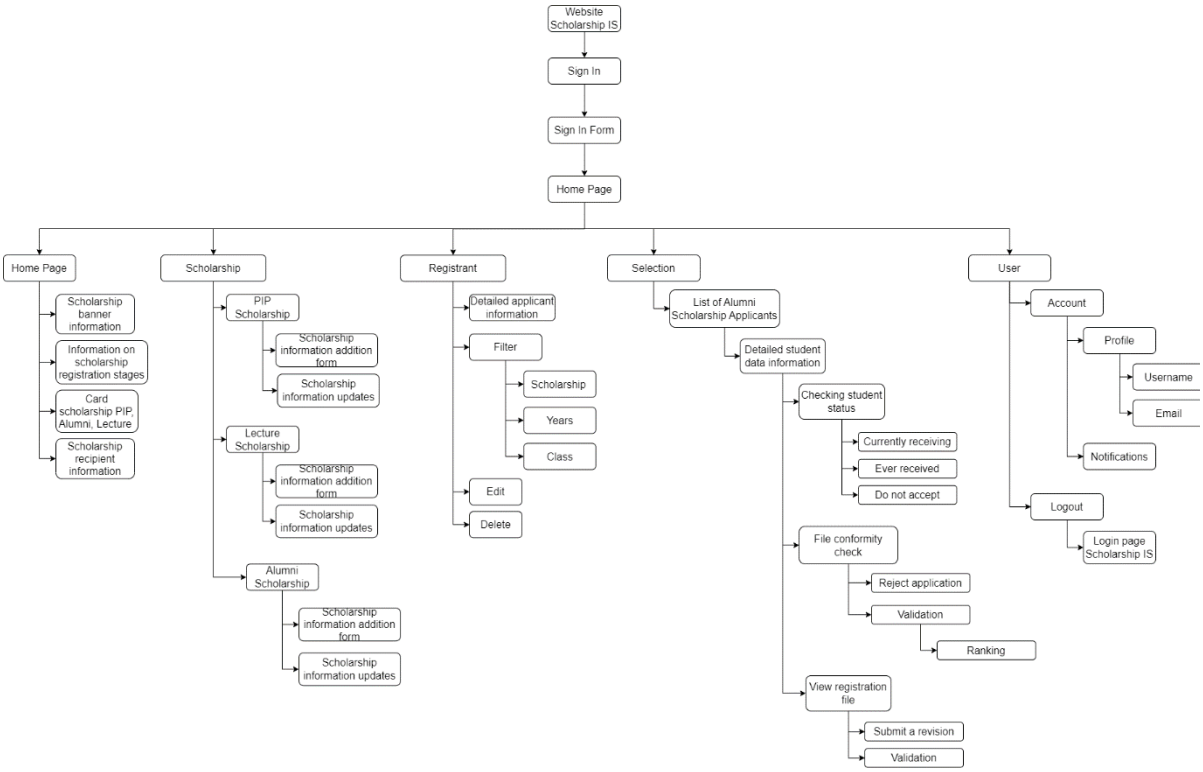

Figure 6. Information Architecture of The Staff

d) User Flow

User flow is used to describe the use of the Scholarship Information System from beginning to end for three groups of users. There are 12 user flow, including login (student), scholarship requirements (student), user (student), login (teacher), scholarship requirements (teacher), registrant (teacher), user (teacher), login (employee), scholarship (employee), registrant (employee), selection (employee), user (employee). Some of the main user flows can be seen in Figures 10 and Figure 11.

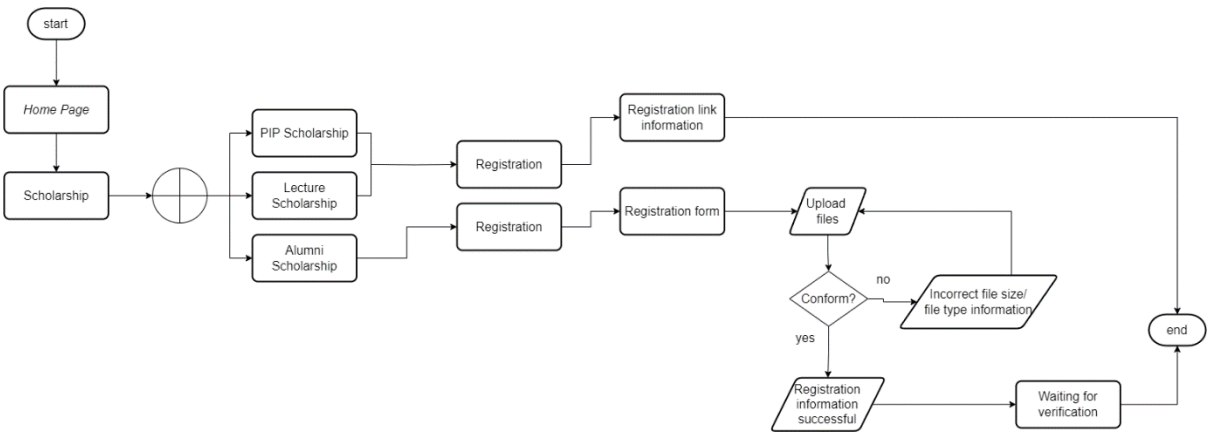

Figure 10. User Flow Scholarship Requirements (Students)

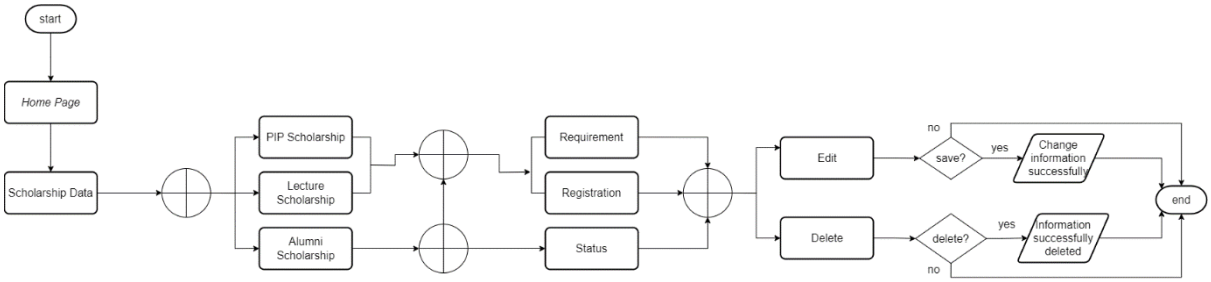

Figure 11. User Flow Scholarship (Staff)

D. Prototype

The prototype phase was carried out to produce a Scholarship Information System design display divided into three user categories, namely students, teachers, and staff. Then, for the use of the font type, use poppins fonts with font sizes that are customized based on the context of the information that will be presented on the Scholarship Information System design. The primary color of the Scholarship Information System is blue, with code #1FA4DC, #29B9E7, and #036C98, because blue can give a feeling of calm, no stress or anxiety, as well as confidence and reliability. In addition, blue is considered a neutral color that can work well in a variety of content types. The logo used in the scholarship system consists of the image of a toga hat, the scroll of the degree, and the inscription of the scholar's scholarships. Some page views on the Scholarship Information System design can be seen in Figures 12–17.

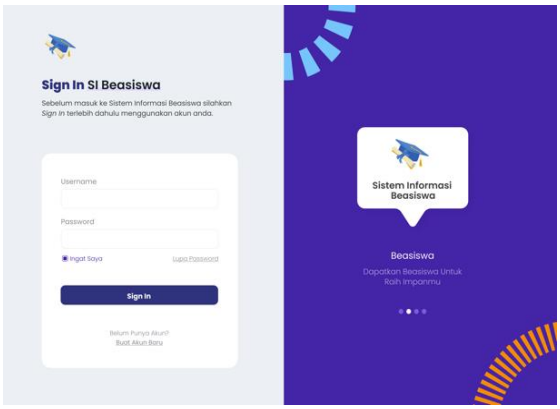

Figure 12. Sign In

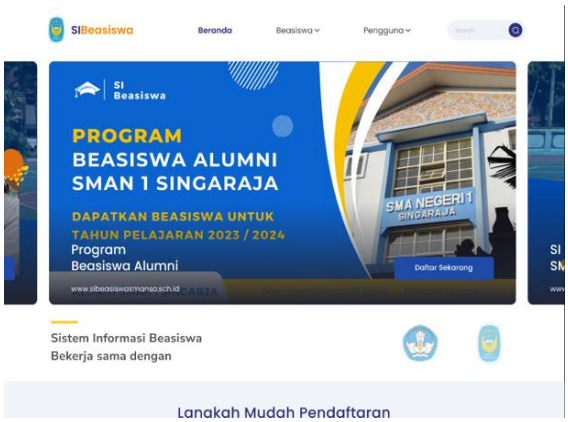

Figure 13. Student Home

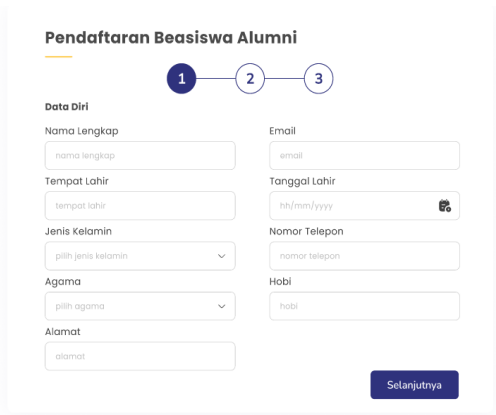

Figure 14. Alumni Scholarship Application Form

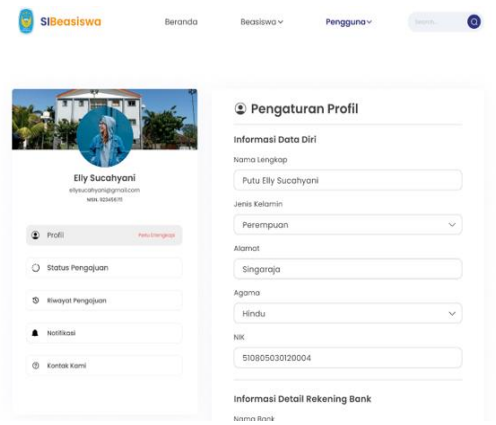

Figure 15. Student Profile

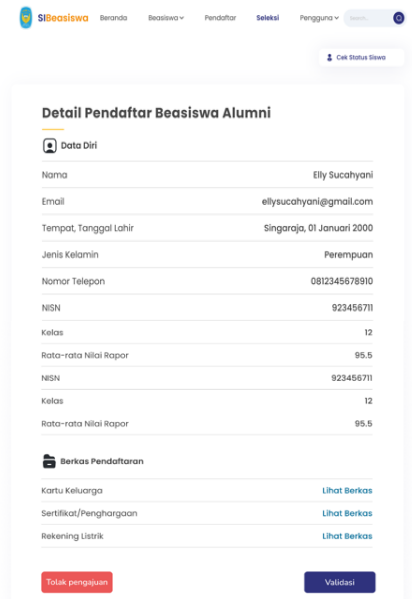

Figure 16. Selection of Alumni Scholarships (Staff)

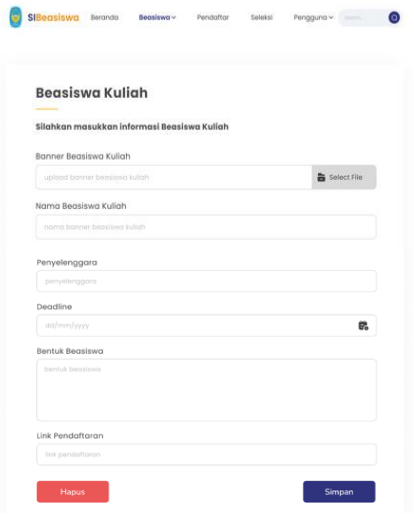

Figure 17. Scholarship Information Form (Staff)

E. First Test

Testing was conducted by providing task scenarios to respondents based on their categories. The respondents were divided into three categories such as 20 students, 5 teachers, and 5 staff members. After completing the task scenarios, respondents filled out the UMUX questionnaire and verbally expressed their feelings about the prototype system during testing. There were 10 task scenarios for student users, 9 task scenarios for teacher users, and 11 task scenarios for staff users. Effectiveness was measured by the average score based on the success and failure of the task scenarios given to respondents. The test results showed effectiveness levels of 83% for students, 98% for teachers, and 84% for staff. Efficiency was measured by calculating the average time in seconds to complete the task scenarios given to respondents. The efficiency results were 0.11 goals/sec for students, 0.12 goals/sec for teachers, and 0.09 goals/sec for staff. Learnability was measured based on the number of tasks correctly completed by respondents, calculated using the success rate formula. The learnability results were 79% for students, 90% for teachers, and 81% for staff. Errors were measured based on the number of mistakes respondents made in completing the task scenarios. The error rates were 0.17 for students, 0.02 for teachers, and 0.18 for staff. The UMUX questionnaire results showed an overall average score of 88, indicating that the design of the Scholarship Information System is acceptable with an excellent rating and B rank. Think-aloud feedback from 30 respondents showed positive responses, stating that the Scholarship Information System design is good, attractive, easy to use, simple, and sufficiently detailed. However, some improvements are needed, such as adding a form to upload certificates in the PIP scholarship application form, adding a feature for teachers to register students, and displaying the scholarship status on the homepage.

F. Design Revision

The design revision was done to improve the design based on the results of the test and the think aloud that was done on the respondents during the first test. There are several revisions to the design such as adding a form to upload statement letter to the PIP scholarship registration form for the staff view, adding features to register in the Alumni Scholarships menu for teachers, and displaying the status of the application on the portal for the student view. Some of the prototype appearances after the revision can be seen in Figures 18 – 23.

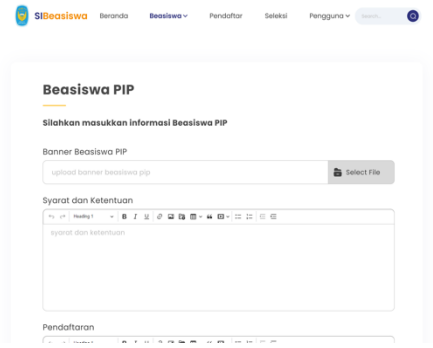

Figure 18. PIP Scholarship Forms Before Improvement (Staff)

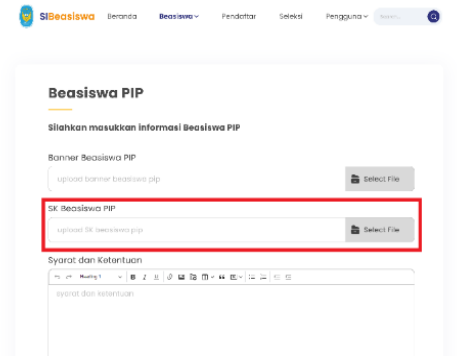

Figure 19. PIP Scholarship Forms After Improvement (Staff)

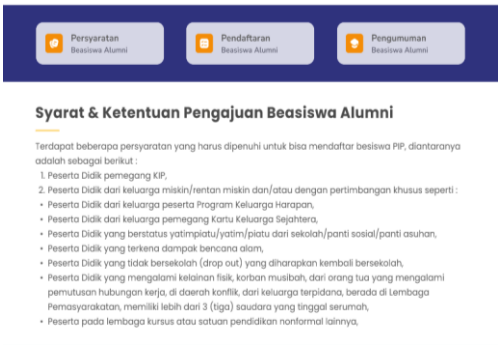

Figure 20. Alumni Scholarship Menu Before Improvement (Teacher)

Figure 21. Alumni Scholarship Menu After Improvement (Teacher)

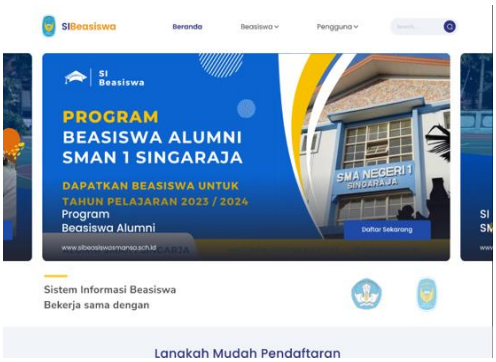

Figure 22. Student Home Before Improvement

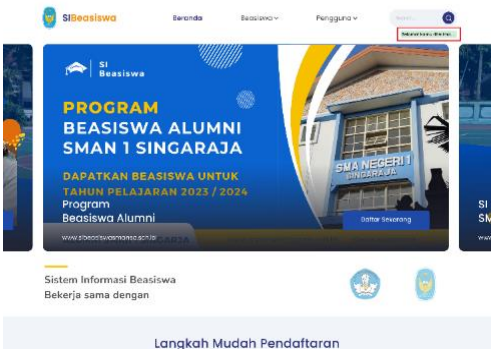

Figure 23. Student Home Before Improvement

G. Second Test

The second test was conducted on the revised prototype with the same respondents and using the same testing techniques as the first test. The results of the second test in terms of effectiveness showed an improvement in all three user groups, achieving a score of 100%. The second test results for efficiency showed an increase in all three user groups, with scores of 0.25 goals/sec for students, 0.15 goals/sec for teachers, and 0.13 goals/sec for staff. The results of the second test for learnability showed an increase, with a score of 94% for students, a decrease to 85% for teachers, and an increase to 83% for staff. The decrease in the teacher respondents was due to more respondents completing the tasks partially, meaning the respondents did not fully complete the tasks according to the given task scenarios. However, the respondents already understood the workflow of each task scenario. Furthermore, the second test results for error showed an improvement, with an error rate of 0 for all

three user groups. According to [16], the average error rate per task is 0.7. The error rates of all three respondent groups in using the Scholarship Information System were below the average, indicating that this scholarship design is good for implementation. The second test results using the UMUX questionnaire showed an increase, with an average score of 92 for all respondents, indicating that the design of the Scholarship Information System is acceptable with a "best imaginable" rating and A rank. The think-aloud results from the second test for all respondents indicated that the improvements made could facilitate user needs and make it easier for users to understand the system's workflow. Figures 24 - 28 show a comparison of the first and second test results.

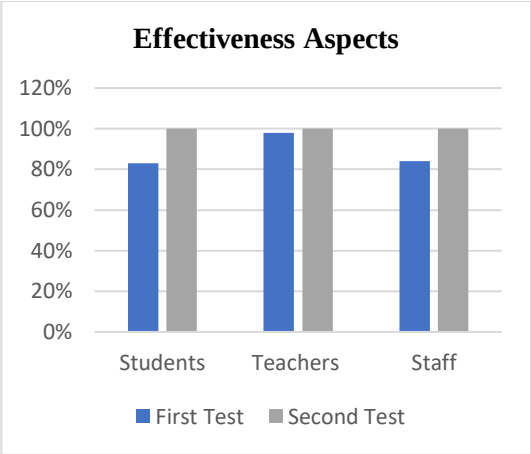

Figure 24. Comparison of Effectiveness Aspects

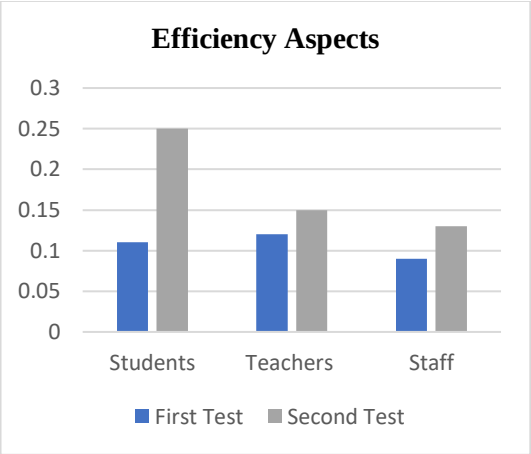

Figure 25. Comparison of Efficiency Aspects

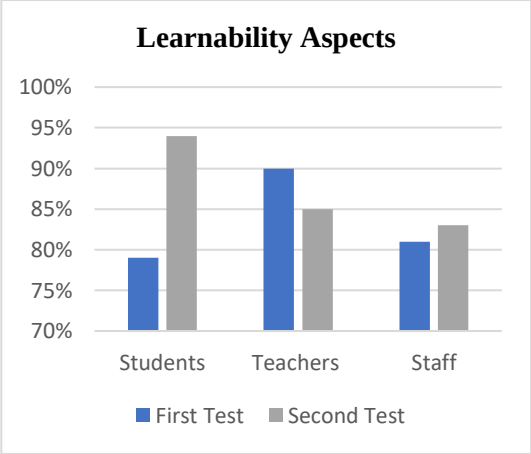

Figure 26. Comparison of Learnability Aspects

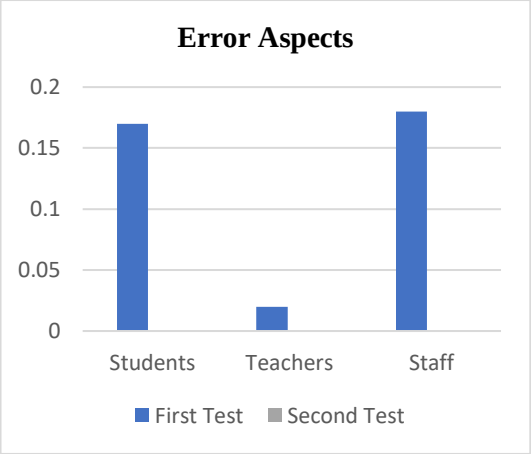

Figure 27. Comparison of Error Aspects

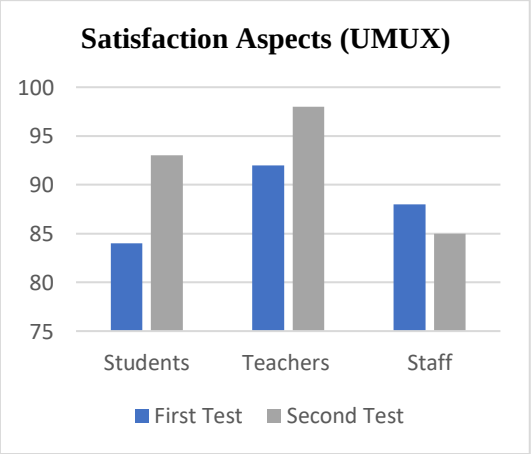

Figure 28. Comparison of Satisfaction Aspects (UMUX)

4. CONCLUSION

In the research to design the scholarship information system using the design thinking method, five stages were implemented. The first stage, empathize, involved building a deep understanding of users through an empathy map. The second stage, define, articulated the problem clearly and produced user personas, points of view, and pain points. The third stage, ideate, generated creative ideas and included “how might we" questions, prioritization ideas, information architecture, and user flow. The fourth stage, prototype, visualized the ideas in the form of a prototype. The fifth stage, test, was conducted twice with 30 respondents, measuring five aspects: effectiveness, efficiency, learnability, errors, and user satisfaction. The results from the first test were used to make design improvements, and the second test showed an increase in effectiveness for students by 17%, teachers by 2%, and staff by 16%. Efficiency aspects increased by 0.14 goals/sec, teachers by 0.03 goals/sec, and staff by 0.04 goals/sec. Learning aspects increased in students 15% and staff 2%, while teachers decreased 5%. Errors dropped to zero which indicates that the error rate made was no mistake. Satisfaction increased by four points. The results indicate that the Scholarship Information System was very well received with a rating of A. Further research could involve implementing the prototype during development and designing a mobile application.

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