Redesigning UI/UX Of Itenas Online Graduation Registration Website Using Lean UX And Post-Study System Usability Questionnaire

Kurnia Ramadhan Putra [1,*], and *Diky* Akmal Fauzi[2]

[1] Departmen of Information System, Institut Teknologi Nasional (Itenas), Bandung, Indonesia
[2] Departmen of Information System, Institut [1]Teknologi Nasional (Itenas), Bandung, Indonesia

Abstract. Rapid advancement of Information Technology has accelerated the flow of information and data. The National Institute of Technology (Itenas) has improved its services with an online graduation registration system (Pendaftaran Wisuda Online). However, based on observations and the result of Post-Study System Usability Questionnaire (PSSUQ) revealed negative experiences on the website. Based on PSSUQ scores, where lower values indicate better performance, it averaged 3.31 for SYSUSE, 3.41 for INFOQUAL, and 3.71 for INTERQUAL, all of which exceeded the Upper Limit of PSSUQ. This suggests room for enhancing usability and user experience. Addressing this, a study focused on redesigning Itenas' Graduation Registration website using the Lean UX approach and evaluating it through Usability Testing and PSSUQ. The results of usability testing included effectiveness, efficiency, and satisfaction aspects. Effectiveness scored 90.5%, surpassing the 78% average. Efficiency achieved a time of 0.0658 goal/seconds. For the satisfaction aspect, assessed by PSSUQ, achieved significant results, where all sub-scales received scores below the Lower Limit, indicating excellent performance, showed excellent performance with scores below the Lower Limit. SYSUSE scored 1.55, INFOQUAL 1.92, INTERQUAL 1.38, and OVERALL, 1.65. These results indicate that UI/UX improvements fulfilled user needs, marking a successful overhaul of the Itenas Graduation Registration website.

1 Introduction

The current development of Information Technology is experiencing significant acceleration, resulting in faster dissemination of information and data (Yudarmawan, 2020). This is due to the multitude of ideas and innovations that have been developed to streamline the information delivery process [1]. Not only companies, but also universities utilize information technology, and one example is websites. The National Institute of Technology (Itenas) is one of Indonesia's universities that holds an annual graduation program. The graduation program at Itenas is a yearly event held to appreciate students who have

* Corresponding author: kurniaramadhan@itenas.ac.id

successfully completed their studies and are ready to embark on their professional careers. With the advancement of technology and increasing user demands, Itenas continues to enhance its quality to cater to a growing number of students. Itenas has implemented an online graduation registration system to accommodate these needs. Through the online graduation registration website, students can easily access information about registration procedures, requirements, and graduation schedules, enabling them to register quickly and efficiently. However, the ease with which users can perform various activities depends on the design of the user interface and user experience. User Interface and User Experience are crucial components of an application as they facilitate user interaction and provide a comfortable experience [2].

To determine whether a website functions well and aids users or poses difficulties, usability evaluation is crucial. This helps identify necessary changes to improve the website's usability. Design and improvements are also necessary to create a website that users accept [3]. Usability evaluation is performed to assess how well a system meets user needs [4].

In this evaluation, the Post-Study System Usability Questionnaire (PSSUQ) method will be utilized. PSSUQ is a questionnaire designed to assess user satisfaction with computer systems or applications [5]. In PSSUQ, lower scores indicate better performance and satisfaction. PSSUQ consists of 16 standardized questions aimed at measuring end-user satisfaction with a system or application, focusing on information quality [6]. The results of the PSSUQ analysis are divided into four sub-scores: System Usefulness (SYSUSE), Information Quality (INFOQUAL), Interface Quality (INTERQUAL), and OVERALL. Scores range from 1 to 7, with lower scores indicating better user experience than higher scores [5]. From the distributed PSSUQ, SYSUSE scored 3.31, INFOQUAL scored 3.41, INTERQUAL scored 3.71, and OVERALL scored 3.43. All scores obtained exceeded the PSSUQ upper limit, indicating very low perceived usability and user satisfaction for the Graduation Registration website.

The redesign process of the Itenas Online Graduation Registration website will employ the Lean UX method. Lean UX comprises four stages: Outcomes Assumptions Hypothesis, Design It, Create an MVP, Research and Learn [7]. Lean UX is chosen because the prototype in this study is assumption-based and needs validation. This method is used in design with the aim of faster completion [8]. Lean UX is an experimental method that aims to enhance user experience while maximizing process efficiency by eliminating unnecessary documentation [7].

2 Methodology

2.1 Lean UX

Lean UX is a design approach that emphasizes process speed and places a strong focus on the needs of the system's users [7]. This method aids in minimizing waste during the UI/UX design process. Instead, the Lean UX approach only generates designs necessary for driving learning forward. In Lean UX, there is a shift in mindset through the adoption of an experiment-based and validated learning model [7]. Lean UX employs rapid experimentation and measurement to gain user insights into the developing experience, evaluating to what extent the ideas meet user needs. Lean UX acknowledges that most requirements are assumptions that need validation. While requirements may seem unquestionable, assumptions explicitly recognize the potential for errors [7]. Therefore,

assumptions are used to formulate and test hypotheses. Minimum Viable Products (MVPs) are created to test the validity of these hypotheses. The Research & Learning phase in Lean UX involves testing to mitigate the risk of straying too far in the wrong direction. This testing phase assesses customer behaviour to evaluate the achievement of desired goals. The Lean UX method comprises four stages of UX development: Outcomes Assumptions Hypotheses, Design It, Create an MVP, and Research and Learn can be shown in Figure 1.

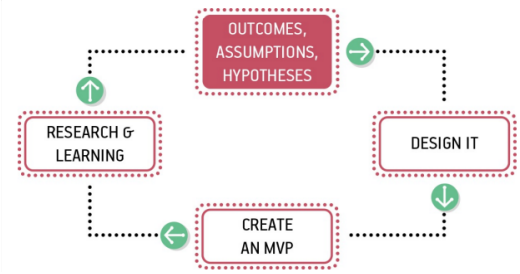

Fig. 1. The Lean UX Process

2.2 Post-Study System Usability Questionnaire (PSSUQ)

The Post-Study System Usability Questionnaire (PSSUQ) is a questionnaire designed to assess user satisfaction with a computer system or application [5]. PSSUQ is a method consisting of 16 standard questions to measure the level of user satisfaction with a system or application, focusing on the quality of information provided by the system or application [6]. This questionnaire can also be used to measure the usability of a system or application [5]. PSSUQ also provides assessment norms that can be used as references to compare results obtained from calculating the PSSUQ questionnaire. PSSUQ generates four values: one overall value and three subscale values. These values are Overall, System Usefulness (SYSUSE), Information Quality (INFOQUAL), and Interface Quality (INTERQUAL). The closer the results approach the Lower Limit of the assessment norms, the better the calculated outcomes [5].

2.2.1 SYSUSE

System Usefulness (SYSUSE), consisting of questions 1 to 6 Formula (1) is a formula used to calculate the total of question components in the System Usefulness category assessment with the variable name SYSUSE, the formula can be utilized as follows:

$$System\ Usefullness\ = \frac{\sum_{j=1}^{m} SYSUSE_{(j)}}{m} \quad (1)$$

Note:
j = Question Component
SYSUSE = System Usefulness
m = Number of questions for the PSSUQ subscale

$$System\ Usefullness\ =\ \frac{\sum_{i=1}^{n}\left(\frac{\sum_{j=1}^{m} SYSUSE_{(j)}}{m}\right)}{m \bullet n} \quad (2)$$

Formula (2) is used to find the average of the sum of question components' results for the System Usefulness category, using the variable name SYSUSE that has been previously calculated and then averaged based on the number of respondents. The formula can be expressed as follows:

j = Question component
SYSUSE = System Usefulness
n = Number of respondents

2.2.2 INFOQUAL

Score System Information Quality (INFOQUAL), which consists of questions 7 to 12. Formula 3 is the formula for calculating the total number of question components in the assessment of the Information Quality category using the variable name INFOQUAL, then the formula can be used:

$$Information\ Quality\ =\ \frac{\sum_{j=1}^{m} INFOQUAL_{(j)}}{m} \quad (3)$$

Note:
j = Question components
INFOQUAL = Information Quality
m = Number of questions for the PSSUQ subscale

Formula 4 is the formula for calculating the average of the summed components of questions for the Information Quality category, with the variable name INFOQUAL. This variable has been computed and then averaged based on the number of respondents. Therefore, the formula that can be used is:

$$Information\ Quality\ =\ \frac{\sum_{i=1}^{n}\left(\frac{\sum_{j=1}^{m} INFOQUAL_{(j)}}{m}\right)}{m \bullet n} \quad (4)$$

Note:
j = Question components
INFOQUAL = Information Quality
n = Number of respondents

2.2.3 INTERQUAL

The Information Quality Score System (INFOQUAL), consisting of questions 13 to 15. The formula is used to calculate the sum of question components in assessing the Interface Quality category, with the variable named INTERQUAL. Therefore, the formula that can be used is:

$$Interface\ Quality\ =\ \frac{\sum_{j=1}^{m} INTERQUAL_{(j)}}{m} \quad (5)$$

Note:

j = Question components
INTERQUAL = Interface Quality
n = Number of questions for the PSSUQ subscale

Formula 6 is the formula for calculating the average of the summed components of questions for the Interface Quality category, using the variable name INTERQUAL. This variable has been computed and then averaged based on the number of respondents. Therefore, the formula that can be used is:

$$Interface\ Quality\ =\ \frac{\sum_{i=1}^{n}\left(\frac{\sum_{j=1}^{m} INTERQUAL_{(j)}}{m}\right)}{m \bullet n} \tag{6}$$

Note:
j = Question components
INTERQUAL = Interface Quality
n = Number of respondents

2.2.4 OVERALL

The formula is used to calculate the sum of question components in assessing the Overall category, with the variable named OVE. Therefore, the formula that can be used is:

$$Overall\ =\ \frac{\sum_{j=1}^{m} OVE_{(j)}}{m} \tag{7}$$

Note:
j = Question components
OVE = Overall
m = Number of questions for the PSSUQ subscale

Formula 8 is the formula for calculating the average of the summed components of questions for the Overall category, using the variable name OVE. This variable has been computed and then averaged based on the number of respondents. Therefore, the formula that can be used is:

$$Overall\ =\ \frac{\sum_{i=1}^{n}\left(\frac{\sum_{j=1}^{m} OVE_{(j)}}{m}\right)}{m \bullet n} \tag{8}$$

Note:
j = Question Component
OVE = Overall
n = Number of respondents

3 Results

3.1 Research and Learning

At this stage, the process of collecting data from users is conducted through observation and questionnaire distribution to understand the user context regarding the ITENAS

Graduation Registration website. Subsequently, an analysis of this data is carried out to obtain user characteristics, issues, needs, goals, and user activities [7]. After creating a list of assumptions, the next step is to transform the results of these assumptions into Hypothesis Statements to facilitate testing.

3.1.1 Calculation of Respondent Samples

Based on the population data of graduates from the ITENAS Bachelor's Graduation Book for the October 2022 period and the ITENAS Bachelor's Graduation Book for the October 2023 period, there were 788 graduates in the October 2022 period and 491 graduates in the March 2023 period, making a total of 1279 graduates. At this stage, the calculation of the sample size is conducted using the Slovin formula with a margin of error of 10% or 0.1. After performing calculations using the Slovin formula, it was determined that the minimum required number of respondents is 93 individuals. Once the minimum number of respondents has been determined through the sample calculation, the next step is to distribute the questionnaire using Google Form.

3.1.2 Demographic Data

The Demographic Data consists of gender, age, study program, year of enrolment, and graduation period. Based on the data in Fig.2, which illustrates the demographics of the study programs, there are out of the 14 study programs at Itenas, the Urban and Regional Planning study program has the highest number of respondents with 19.6%, in total 20 respondents. This is followed by the Information Systems study program with 18.6%, or a total of 19 respondents. Meanwhile, the Product Design and Chemical Engineering study programs have the fewest respondents, only 2 people can be shown in Figure 2.

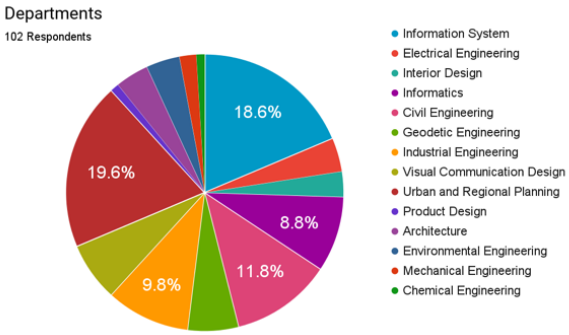

Fig. 2. Respondent Demographic Data

3.1.3 Analysis of PSSUQ Results Before Redesign

Table 1 presents the results of the PSSUQ questionnaire calculation using Google Form. Each question yields a different score, depending on the responses selected by the respondents, whether agreeing or disagreeing with each posed question. The table displays the average scores calculated for each question item presented to the respondents. The lower the score, the better the performance and satisfaction with the ITENAS Online Graduation Registration website. It compares the calculation results with the assessment

norms of PSSUQ version 3 and visualizes them through a line graph can be shown in Table 1.

Table 1. PSSUQ Norms

	SYSUSE	INFOQUAL	INTERQUAL	OVERALL
Lower limit	2.57	2.79	2.28	2.62
Mean	2.8	3.02	2.49	2.82
Upper limit	3.02	3.24	2.71	3.02
Itenas Graduation Registration Website	3.31	3.41	3.71	3.43

The visualization of the comparison of PSSUQ questionnaire calculation results provides a comparison for each value of System Usefulness (SYSUSE), Information Quality (INFOQUAL), and Interface Quality (INTERQUAL), as well as the overall score (OVERALL), using the assessment norms of PSSUQ Version 3. Fig. 3 is a line diagram that compares the results of the PSSUQ questionnaire calculation with the assessment norms of PSSUQ Version 3. If the questionnaire results are compared with the assessment norms of PSSUQ Version 3 and reach the upper limit value, then a system or application can be categorized as reasonably acceptable to users. If it reaches the lower limit value, then a system or application can be categorized as acceptable to users. However, if the value is below the lower limit value, then a system or application can be categorized as highly acceptable to users can be shown in Figure 3.

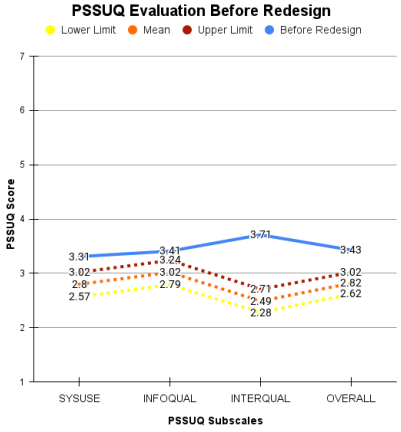

Fig. 3. PSSUQ evaluation before redesign

3.2 Outcomes, Assumptions, Hypotheses

3.2.1 Proto-Personas

Proto personas are created during the early stages of the design process to offer a starting point for understanding the user base. They are not as detailed as fully developed personas but serve as a foundation for further research and design decisions can be shown in **Figure 4**.

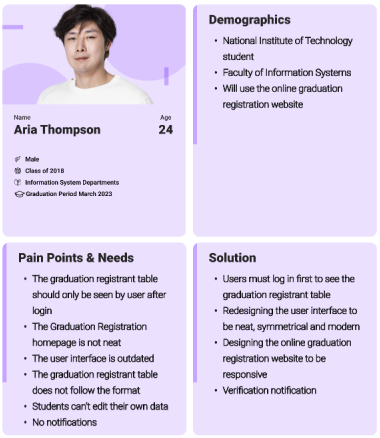

Fig. 4. Proto-Personas

3.2.2 Problem Statements

The initial step that needs to be taken is to define the problem that users are facing. The definition of the problem is obtained through the collection of questionnaire data and interviews. This is structured into problem statements. The results obtained in the creation of problem statements can be shown in Table 2.

Table 2. Problem Statements

Problem Statements	Problem Statements
PS01	Users cannot modify personal data. Changes can only be made by contacting the Academic Bureau via WhatsApp, which is time-consuming.
PS02	Users cannot modify family data. Changes can only be made by contacting the Academic Bureau via WhatsApp, which is time-consuming.
PS03	Users cannot save files temporarily.
PS04	There are no notifications when files and biodata have been verified by the Academic Bureau.
PS05	The homepage of the online graduation registration website features a list of student data in a table format that is accessible to everyone. Respondents feel that personal data should not be displayed without logging in first.
PS07	The homepage of the Online Graduation Registration website lacks neatness due to its off-centre and asymmetrical positioning.
PS08	Users perceive the User Interface of the Online Graduation Registration website as outdated.
PS09	The Online Graduation Registration website is not responsive when used on a computer.
PS010	The table for graduation registrants does not adhere to the predefined column format. Columns like name, program of study, and remarks already exist, but the data is not properly aligned within these columns.

*PS = Problem Statements

3.2.3 Assumptions Worksheets

After completing the PSSUQ calculations and creating problem statements, the question of how to address the issues faced by users arises. The next step is to declare assumption statements as an initial step in the development process. In this context, assumptions refer to potential solutions to the problems or challenges users encounter while using the

ITENAS Online Graduation Registration website. The creation of assumptions is based on data from questionnaires, interviews, and problem statements (Table 3).

Table 3. Assumptions Statements

Assumption Statements	Assumptions Statements	Problem Statements
AS01	Users need a feature to modify personal data that enhances user satisfaction and reduces the time required for data changes.	PS01
AS02	Users need a feature to modify family data that enhances user satisfaction and reduces the time required for data changes.	PS02
AS03	Users need a feature to save temporary files.	PS03
AS04	Users should log in first to access the graduation registrants' table.	PS04
AS05	Users prefer a neat and symmetrical interface.	PS05
AS06	Users prefer a more modern interface.	PS06
AS07	Users prefer the Online Graduation Registration website to be responsive when used on a computer.	PS07
AS08	Users would find it easier to read the graduation registrants' table if data is filled in according to the predefined columns.	PS08
AS09	Users would be assisted if the maximum file size is increased.	PS09
AS10	Users require real-time notifications when their files have been verified by the Academic Bureau.	PS10

*AS = Assumptions Statements

3.2.4 Hypothesis Statements

With the assumption statements already created in Table 4, the next step is to formulate hypotheses. Hypothesis statements involve crafting speculative statements believed to be true, with the potential for receiving feedback from users. Assumption statements are transformed into a format that is more easily testable, namely hypothesis statements. The outcomes of the hypotheses at this stage are shown in Table 4.

Table 4. Hypothesis Statements

Hypothesis Statements	Hypothesis Statements	Problem Statements	Assumption Statements
HS01	We believe that with a feature to change personal data, we anticipate increasing user satisfaction and reducing the time required to make data changes.	PS01	AS01
HS02	We believe that if we implement an easy-to-use family data change feature, we anticipate increasing user satisfaction and reducing the time required to make data changes.	PS02	AS02
HS03	We believe that if we implement the temporary file saving feature, we anticipate an increase in user satisfaction due to the flexibility and convenience.	PS03	AS03
HS04	We believe if we implement a login that is required first to view the graduation applicants table and it is not publicly accessible, then we believe an increased sense of data security is higher, leading to a reduction in unauthorized access to personal information.	PS04	AS04
HS05	We believe if we redesign the interface to be neater and symmetrical, then users will show a higher level of engagement and satisfaction on the Online Graduation Registration website.	PS05	AS05
HS06	We believe that if we update the interface with a modern design, there will be increased user engagement and higher levels of user satisfaction.	PS06	AS06
HS07	We believe that if we apply a responsive design that adapts seamlessly to various sizes of computer devices, it can increase accessibility, satisfaction, and a positive perception of the Online	PS07	AS07

Hypothesis Statements	Hypothesis Statements	Problem Statements	Assumption Statements
	Graduation Registration website.		
HS08	We believe that if we present the graduation registrant table in an organized format with appropriate data filling in each column, it will increase accessibility, satisfaction, and positive perceptions.	PS08	AS08
HS09	We believe that if we present the graduation registrant table in an organized format with appropriate data filling in each column, it will increase accessibility, satisfaction and positive perceptions.	PS09	AS09
HS10	We believe if we provide users with real-time notifications once a file is BA verified, it will increase user satisfaction and create a smoother user experience.	PS10	AS010

*H = Hypothesis Statements

3.2.5 Mind Map of Online Graduation Registration

After identifying the issues and user needs, a mapping of the problem statement, assumptions, and hypotheses is created to be applied to the design of the new Online Graduation Registration website in the form of a mind map. Mind mapping is a visual technique used to help organize and structure ideas into a more organized framework. The created mind map includes eleven hypotheses derived from problem identification and user needs. This mind map itself illustrates the relationships from Problem Statements, Assumption Statements, to Hypothesis Statements. The points highlighted in red lines represent the Problem Statements referenced from Table 4, while those in yellow lines represent the Assumption Statements referenced from Table 3, and those in green lines represent the Hypothesis Statements for the development of the new Online Graduation Registration website. For a visual representation of the mind map refer to Figure 5.

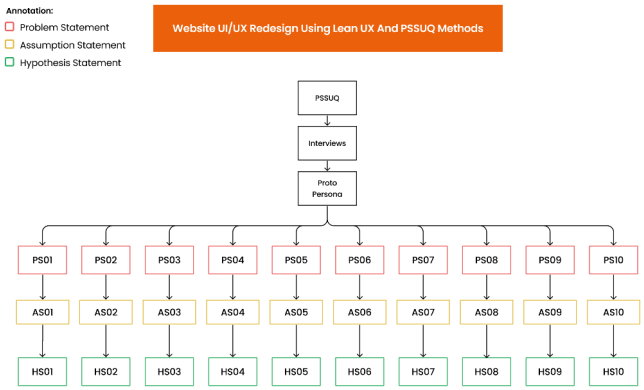

Fig. 5. Mind map of Online Graduation Registration

3.3 Design it

The Design It phase is a stage in creating the wireframe of the system to be developed based on user requirements. After that, a style guide is created for the upcoming system. The style guide includes colors, font guidelines, menus, icons, and buttons, referring to the earlier assumptions. Below are the outcomes of the collaborative design for the ongoing ITENAS Graduation Registration website development:

3.3.1 Site Map

Before commencing the page design for the ITENAS Graduation Registration website, a sitemap was created to serve as the main structure of the application and determine the flow of each feature within it. The sitemap for the ITENAS Graduation Registration website can be viewed in Figure 6.

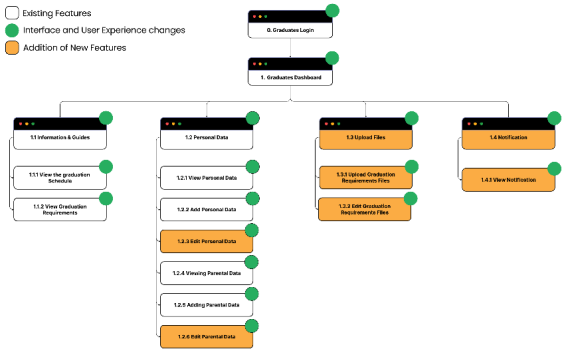

Fig. 6. Site Map of ITENAS Graduation Registration Website

3.3.2 User Flow

User flow refers to the series of steps and interactions that a user takes while navigating through a website, application, or system to achieve a specific goal. It outlines the path a user follows, from their initial entry point to the final desired action or outcome. User flow involves understanding the sequence of screens, actions, and decisions that users encounter, ensuring a smooth and intuitive experience. One example of user flow can be viewed in Figure 7.

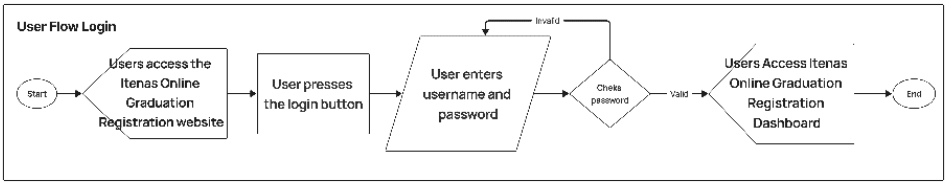

Fig. 7. User Flow Login

3.3.3 Wireframe

The ideas that have been mapped out during the ideation stage in the form of a mind map will be implemented in wireframes, which serve as an initial representation that will later be developed into high-fidelity designs. Figure 8 represents the wireframe for the Login screen.

3.4 Create an MVP

Creating an MVP is a phase in developing a prototype that can simulate user interactions to experience the developed website according to the hypotheses – whether they are correct, need to be discarded, or require improvement. The MVP is created using the Figma

application. Below is the result of the MVP for the Login feature on the ITENAS Graduation Registration website can be shown in **Figure 9**.

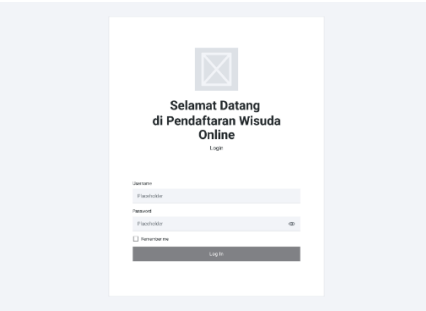

Fig. 8. Wireframe Login

Fig. 9. MVP Login

3.5 Research and Learn

3.5.1 Usability Testing

Usability has three attributes: effectiveness, efficiency, and satisfaction. Effectiveness measures how well a tool or product assists users in accomplishing their tasks. Efficiency pertains to the smoothness with which users achieve the goals of their tasks. Satisfaction measures the user's acceptance of the tested product to determine whether a product has provided satisfaction to its users and is appropriate of use can be shown in Table 5.

1. Effectiveness

Table 5. Effectiveness testing

Tasks	R1	R2	R3	R4	R5	R6	Task Completed	Task Failed	PSSUQ Subscale
T1	S	S	S	S	S	S	6	0	SYSUSE,INTERQUAL
T2	S	S	F	S	S	S	5	1	SYSUSE,INTERQUAL
T3	S	S	S	S	S	S	6	0	SYSUSE,INTERQUAL
T4	S	S	S	S	F	S	5	1	SYSUSE,INTERQUAL
T5	S	S	S	S	S	S	6	0	INFOQUAL,INTERQUAL
T6	S	S	S	S	S	S	6	0	INFOQUAL,INTERQUAL
T7	S	S	F	S	F	S	4	2	INFOQUAL,INTERQUAL
Total							38	4	

Note: C = Completed, F=Failed

$$Effectiveness = \frac{Number\ of\ tasks\ completed\ successfully}{Total\ nmber\ of\ task\ undertaken} X\ 100\% \quad (9)$$

$$= \frac{38}{42} X\ 100\% = 90,5\%$$

Based on the information provided in Table 4.1, it can be observed that the average completion rate achieved is 90.5%. Referring to the standard criteria of Effectiveness according to [17], even though the goal to achieve is a completion rate of 100%, based on a study conducted by Jeff Sauro, the average task completion rate is 78% (based on an analysis of 1,100 tasks). The achieved completion rate of 90.5% on the ITENAS Graduation Registration website exceeds 78%. Therefore, it can be concluded that the improvements to the ITENAS Graduation Registration website exhibit a high level of Effectiveness quality.

2. Effectiveness

Efficiency is measured in terms of task time, which refers to the time (in seconds and/or minutes) participants take to successfully complete a task. The time required to complete a task can then be calculated by simply subtracting the start time from the finish time, as shown in the equation below:

$$Time\ Based\ Efficiency = \frac{\sum_{j=1}^{R}\left(\sum_{i=1}^{N}\frac{n_{ij}}{t_{ij}}\right)}{NR} \quad (10)$$

The recorded times in Table 6 will be used in the calculation process by dividing them. If a respondent successfully completes a task, a score of 1 will be divided by the time recorded for that respondent. However, if a respondent fails to complete a task, a score of 0 will be divided by the recorded time for that respondent.

Table 6. Efficiency Evaluation

Tasks	PSSUQ Subscales	Hypothesis	Respondents						$\left(\sum_{i=1}^{N}\frac{n_{ij}}{t_{ij}}\right)$
			R1	R2	R3	R4	R5	R6	
T1	SYSUSE, INTERQUAL	HS01	14,4s	6,8s	13,4s	4,0s	8,2s	115,4s	=0.561s
T2	SYSUSE, INTERQUAL	HS02	15,8s	23,3s	9,6s (F)	8,0s	11,1s	18,9s	=0.378s
T3	SYSUSE, INTERQUAL	HS03	18,8s	18,5s	12,4s	10,5s	16,3s	27,1s	=0.343s
T4	SYSUSE, INTERQUAL	HS04	20.7s	19.1s	10.0s	17.4s	6.7s (F)	19.7s	=0.308ss
T5	INTEQUAL, INTERQUAL	HS05, HS06	12.1s	23.6s	14.3s	19.2s	9s	34.1s	=0.387s
T6	INTEQUAL, INTERQUAL	HS08, HS09	14,1s	14,6s	40.5s	12,1s	9,5s	6,1s	=0.515s
T7	INTEQUAL, INTERQUAL	HS10	25,2s	91,1s	5,2s (F)	4,7s	2,9s (F)	64,9s	=0.278s
$\sum_{j=1}^{R}\left(\sum_{i=1}^{N}\frac{n_{ij}}{t_{ij}}\right)$									=2.766s

Note: F = Failed

$$Time\ Based\ Efficiency = \frac{\sum_{j=1}^{R}\left(\sum_{i=1}^{N}\frac{n_{ij}}{t_{ij}}\right)}{NR} \quad (11)$$

Next, calculations are performed using the Time Based Efficiency formula as follows:

$$= \frac{0.561+0.374+0.343+0.308+0.387+0.515+0.278}{7\ X\ 6}$$

$$= 0,0658\ goal/second$$

The result of the time-based efficiency calculation is 0.0658 goals per second, obtained by dividing the total calculated time required by users to complete tasks. This indicates that on average, each respondent can complete 0.0658 seconds per task given.

3. Satisfaction

PSSUQ is divided into three sub-scores: System Usefulness (SYSUSE), Information Quality (INFOQUAL), and Interface Quality (INTERQUAL), with scores ranging from 1 to 7, where lower scores indicate a better user experience than higher scores [5]. Here are the results of the PSSUQ after the redesign can be shown in Figure 10.

System Usability (SYSUSE) is one of the elements present in the PSSUQ assessment to evaluate the usability of the ITENAS Graduation Registration website and whether the system meets user needs. Respondents consider the user interface of the ITENAS Graduation Registration website to be highly acceptable, as the average score for the SYSUSE usability assessment is 1.55. This value indicates the level of user satisfaction with interactions on the ITENAS Graduation Registration website. Based on the conclusions drawn from the INFOQUAL subscale results, it can be seen in the table that the ITENAS Graduation Registration website receives an average INFOQUAL score of 1.91.

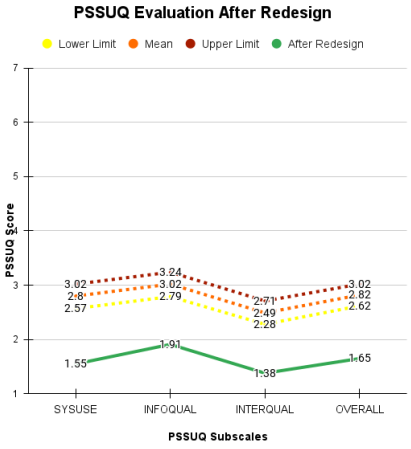

Fig. 10. PSSUQ Evaluation After Redesign

Therefore, the usability level falls within the category of very good, indicating that the ITENAS Graduation Registration website is effective in providing information, error messages, and organizing information. Interface Quality (INTERQUAL) is an element in the PSSUQ that assesses the quality of the interface of the ITENAS Graduation Registration website, including its visual appeal and ease of operation. A good interface quality enhances satisfaction and willingness to use the website. Compatibility in interaction with UI/UX affects ease of use related to new technology. The Interface Quality of the PSSUQ satisfaction achieved a score of 1.38, which is highly acceptable can be shown in Figure 11.

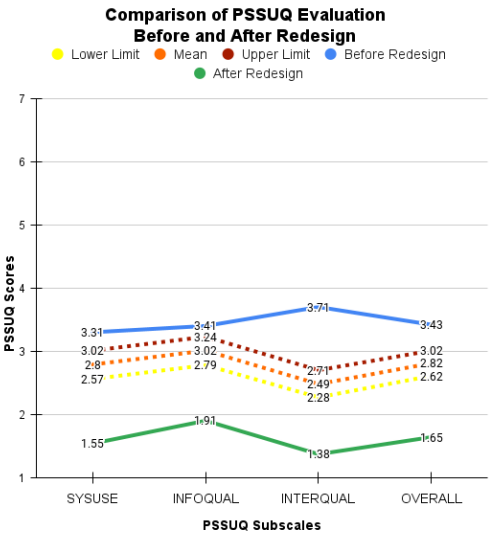

Fig. 11. PSSUQ Comparison Before and After Redesign

The figure illustrates a comparison of the evaluation results before and after the redesign process of the ITENAS Graduation Registration website using PSSUQ. It can be observed that in the SYSUSE subscale, there is a significant decrease from 3.31 to 1.55, falling into the "excellent" usability level, indicating no issues. In the INFOQUAL subscale, there is a drastic decrease in score from 3.41 to 1.91. In the INTERQUAL subscale, there is a significant drop from 3.71 to 1.38. In the OVERALL subscale, the score decreases from 3.43 to 1.65, also falling into the "excellent" usability level, signifying no issues.

4 Conclusion

Based on the research conducted regarding the Redesign of the ITENAS Graduation Online Registration Website, through the analysis of PSSUQ and interviews conducted, it was found that users faced several problems and difficulties when using the old interface of the ITENAS Graduation Registration website. Some of these issues include the lack of an editing feature for student personal and family data. To modify personal data, users had to contact the Academic Bureau via WhatsApp, which was time-consuming. In the Upload Documents section, users had to upload 12 files simultaneously, and there was no feature to temporarily save files. Users also did not receive notifications when their documents were approved by the academic bureau. Regarding the User Interface, users felt that the ITENAS Graduation Registration website was outdated and not user-friendly. Additionally, the layout of the website was disorganized, lacked symmetry, and was not responsive on small-sized devices. Lean UX is a UI/UX design approach that focuses on delivering value quickly through collaboration, iteration, and user-centered thinking.

The Lean UX process starts with Outcomes-Assumptions-Hypotheses, Design It, Create an MVP, and Research & Learning. Its purpose is to formulate and test hypotheses, aiming to effectively solve user problems while minimizing waste and maximizing learning. This process is iterative, allowing rapid adjustments based on user feedback, resulting in more efficient and user-centered design solutions.

Post-Study System Usability Questionnaire (PSSUQ) is a standardized questionnaire used to assess perceived usage and user satisfaction with software systems or applications after user interaction. PSSUQ consists of a series of questions designed to collect feedback on various usage aspects, user interfaces, and overall user experiences. It helps researchers and designers understand how users perceive the usability of the system and identify areas for improvement. In PSSUQ, the lower the score obtained, the better the calculation results. PSSUQ is divided into 4 subscales: System Usefulness (SYSUSE), Information Quality (INFOQUAL), Interface Quality (INTERQUAL), and Overall. The results of usability testing encompass two analyzed aspects: effectiveness and satisfaction. In the effectiveness aspect, a score of 90.5% was achieved, which is above average. In the satisfaction aspect, using the PSSUQ questionnaire yielded significant results, where all subscales obtained scores below the Lower Limit, indicating excellent usability. The SYSUSE subscale obtained a score of 1.55, INFOQUAL obtained a score of 1.92, INTERQUAL received a score of 1.38, and OVERALL received a score of 1.65, indicating that the UI/UX improvements to the ITENAS Graduation Registration website have met user needs.

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References

1. R. A. Yudarmawan, A. A. K. O. Kompiang, and D. M. S. Arsa, "Perancangan User Interface dan User Experience SIMRS pada Bagian Layanan," *J. Ilm. Teknol. dan Komput.*, vol. 1, no. 2, pp. 222–233, 2020, [Online]. Available: https://www.neliti.com/id/publications/351388/
2. M. B. Wiryawan, "User Experience (Ux) sebagai Bagian dari Pemikiran Desain dalam Pendidikan Tinggi Desain Komunikasi Visual," *Humaniora*, vol. 2, no. 2, p. 1158, 2011, doi: 10.21512/humaniora.v2i2.3166.
3. D. Pratiwi, M. Chandra Saputra, and N. H. Wardani, "Penggunaan Metode User Centered Design (UCD) dalam Perancangan Ulang Web Portal Jurusan Psikologi FISIP Universitas Brawijaya," 2018.
4. I. K. Dewi, Y. T. Mursityo, R. Regasari, and M. Putri, "Analisis Usability Aplikasi Mobile Pemesanan Layanan Taksi Perdana Menggunakan Metode Webuse dan Heuristic Evaluation," *J. Pengemb. Teknol. Inf. dan Ilmu Komput.*, vol. 2, no. 8, pp. 2909–2918, 2018.
5. J. Sauro and J. R. Lewis, *Quantifying the user experience: practical statistics for user research by Jeff Sauro and James R. Lewis*, vol. 38, no. 1. 2016. [Online]. Available: https://dl.acm.org/doi/pdf/10.1145/2413038.2413056?casa_token=eJqR7mWbspIAAAAA:0BnizGhclY138Ux7Hyq2hD6C6bXKvzDNVqDPG0aCfDgvjHOIzzGvdHxvw58ASuMbcALm4xxE3Bcg
6. N. Rahmah, R. I. Rokhmawati, and L. Fanani, "Evaluasi dan Perbaikan Antarmuka Pengguna Situs Web Otoritas Kompeten Badan Karantina Ikan, Pengendalian Mutu dan Keamanan Hasil Perikanan (BKIPM) dengan menggunakan Metode Goal-Directed Design (GDD)," *J. Pengenbangan Teknol. Inf. dan Ilmu Komput.*, vol. 5, no. 4, pp. 1442–1451, 2021, [Online]. Available: http://j-ptiik.ub.ac.id
7. J. Gothelf and J. Seiden, *Lean UX - Designing Great Products with Agile Teams*. 2016. [Online]. Available: http://tdavis.davissoft.com/Lean_UX.pdf
8. R. Trisminingsih and D. Nurliaputri, "User experience design of task-management application for plantation supervisor using lean UX," *Proc. - 2019 5th Int. Conf. Sci.*

Technol. ICST 2019, pp. 16–19, 2019, doi: 10.1109/ICST47872.2019.9166579.