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Improving the User Interface and Experience of a Student Portal Through the Eight Golden Rules

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ABSTRACT

One of the crucial web-based academic service facilities in higher education is the Student Portal. Based on a survey of student users, the existing Student Portal at the Institut Teknologi Dirgantara Adisutjipto (Design A) is visually unappealing. It therefore requires improvement in terms of User Interface (UI) design. **The purpose** of this study is to enhance the UI and UX of the Student Portal. **The method** used involved applying the Eight Golden Rules method and the Maze tool to design the UI. The resulting new design (Design B) and the current one (Design A) were tested using A/B testing. This study involved a sample of 41 student users from the Informatics Study Program, as they were considered familiar with UI/UX, along with four staff users selected to represent the overall population of Student Portal users. The instrument that is used to evaluate both designs is the System Usability Scale (SUS). The test **results** show that Design A received an average score of 55.0, which falls into the ”OK” category with a grade of D. In contrast, Design B, which incorporates the Eight Golden Rules method, achieved an average score of 75.0, placing it in the ”GOOD” category with a grade of B. In **conclusion**, the application of the Eight Golden Rules method led to a 36.4% improvement in the UI and UX of the Student Portal.

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1. INTRODUCTION

Web-based academic services have been widely implemented in various universities, allowing students to access information about academics [1–4]. Students are the largest users of university services [2, 3]. One of the crucial web-based academic service facilities in a university is the Student Portal. Most student users access the Student Portal [5]. Among the services provided and facilitated by the Student Portal are lecture schedules, exam scores, thesis exam schedules, semester study plans, academic transcripts, and others [5, 6]. Despite these offered services, many of the Student Portal websites suffer from several problems, one of which is a lack of visual appeal. Visual appeal is related to visibility and aesthetics, as well as memorability and efficiency [7, 8] as for visibility and aesthetics in the form of color elements [9], pictures, fonts, shapes, etc. [10]. Visual appeal problems also occur on the Student Portal website at the Institut Teknologi Dirgantara Adisutjipto (ITD Adisutjipto). This is supported by a survey conducted on Student Portal users at ITD Adisutjipto, involving 41(forty-one) samples of student users from the Informatics Study Program and 4 (four) selected staff users. The survey results indicated that the design of the current Student Portal User Interface (UI), referred to as Design A (Control), is considered less appealing in terms of visibility and aesthetics (including icons, font types, colors, and layout of interface elements), as well as consistency, memorability, and efficiency. These shortcomings negatively impact the effectiveness of the portal and user satisfaction with the services and information presented [11, 12]. The fonts, colors, and icons used in the current version of the Student Portal at ITD Adisutjipto (Design A) are viewed as lacking variety and vibrancy, highlighting the need for an updated and improved UI appearance. According to the survey, the usability of the current Student Portal (Design A) was measured using the System Usability Scale (SUS), which yielded an average score of 55.0. This score corresponds to a rating of ”OK” and falls within a grade scale of D, indicating that further improvements to the UI/UX of the Student Portal are necessary. Although the results of the score assessment are acceptable, several factors need to be considered to improve the design of the UI and User Experience (UX) of the Student Portal [13]. Improving the design of a system’s UI and UX certainly requires a design rule [7, 8, 14]. The UI design rules for an application system include applying the principles of the Eight Golden Rules of UI Design, developed by Ben Shneiderman [7, 8, 15].

Here are some studies related to the application of the Eight Golden Rules method and usability in applications. The study [15] revealed that one of the main factors contributing to system failure or low system quality is a poorly designed and overly complicated UI. A complex UI can lead to a difficult and unintuitive UX. This study utilizes an analysis based on the Eight Golden Rules of UI Design. The research [16] stated that the Meteorology, Climatology, and Geophysics Agency (BMKG) mobile application was not sufficiently user-friendly. Users found it difficult to understand, and the application’s ease of use and comfort did not align with its intended purpose. Therefore, it was necessary to redesign the BMKG mobile application by referring to the Eight Golden Rules of interaction design and evaluating it using the SUS. Initial testing using the SUS method yielded an average score of 60, placing the application in the ’Marginal Low’ category in terms of Acceptability Range, a Grade Scale of ’D’, and an Adjective Rating of ’OK’. Based on this assessment, a proposal was developed to enhance the application design in response to feedback from respondents. A second round of testing was then conducted using the SUS method, resulting in an average score of 80.25. This score placed the application in the ’Acceptable’ category, with a Grade Scale of ’B’ and an Adjective Rating of ’Excellent’. The drawback of this study is that the UX evaluation stage was not conducted, making it impossible to gain deeper insights into users’ responses to the application in terms of both interface and functionality. Related research on application improvement through UX evaluation [16] evaluated UX to improve the design of the Forest Fire Monitoring System Application (SIPONGI) in West Kalimantan. The methods used included User-Centered Design (UCD) and the Website Usability Evaluation Tool (WET). The research methodology involved a literature review of the SIPONGI application and employed a sample of 25 respondents with varying professional backgrounds to represent the application’s user population. The results indicated that usability scores for each attribute and category improved significantly following the UI/UX enhancements.

Based on previous research as outlined above, the objective of this study is to improve the UI and UX of the ITD Adisutjipto Student Portal using the Eight Golden Rules method. The UI/UX enhancements of the Student Portal focus on aspects such as visibility and aesthetics, consistency, memorability, and efficiency [15, 16]. Improvements in visibility and aesthetics include redesigning familiar icons, implementing a consistent and visually appealing color scheme, and creating an attractive layout to facilitate easier access to menus and submenus. Main menu items—such as Home, Profile, Study Plan, Study Results, Transcript, Questionnaire, and Class Schedule—are made easier to locate, and the information displayed in the UI is clear and easy to understand. Consistency and aesthetics [17] have also been improved by using uniform language and terminology throughout the application, which helps prevent user confusion and ensures the consistent presentation of information. Improvements in memorability and efficiency aim to ensure that users do not spend excessive time learning how to use the Student Portal website. To achieve this, it is important to carefully design the composition and layout of UI elements [18–21]. Previous studies have not fully implemented all eight of the Eight Golden Rules; they typically applied only four to six of the rules. In this study, the redesigned interface was re-evaluated by users and measured using the SUS to determine whether the new design was superior to the previous one. Although prior research

has used SUS to evaluate existing applications, this method has rarely been used to assess updated or redesigned UIs.

The research results indicate that the improvement from UI/UX Design A to Design B, following the rules directed by the Eight Golden Rules method, demonstrates the effectiveness and efficiency of the UI/UX in the ITD Adisutjipto student portal. Additionally, it produces an interface that is more visually appealing, intuitive, consistent, user-friendly, and provides accessible information. This study can also serve as a reference for the development of better UI/UX design in other information systems within the ITD Adisutjipto units. Our approach to enhancing the UI and UX can also be beneficial for government offices that deliver public services, companies that promote their products and services, and schools at all levels, enabling them to deliver better services to their students.

2. RESEARCH METHOD

Data collection in this research employed both quantitative and qualitative methods. The quantitative approach was used to gather numerical data from student and staff respondents. Survey data were processed using data tabulation and descriptive analysis methods. The results showed that 97.6% of respondents agreed with the development of the UI design, including changes in color, size, layout, text, and other elements intended to enhance the UX [9, 16, 22]. A qualitative approach was employed by conducting interviews with ITD Adisutjipto students. The sample population consisted of students from the Informatics Study Program who used the Student Portal, as well as selected staff users from the Information Technology Service Center (ITSC) and non-ITSC staff. In addition, a literature review was conducted to support the research by reading, citing, and documenting relevant sources.

Several stages in the research for developing the UI and UX of the ITD Adisutjipto Student Portal website are illustrated in Figure 1. This diagram outlines the systematic process starting from identifying critical issues within the system, determining appropriate research methodologies, collecting relevant data, designing variant B for comparison, adhering to the principles of the Eight Golden Rules of UI Design, conducting comprehensive system testing, implementing A/B testing and Maze Design experiments, carrying out SUS, meticulously analyzing gathered data, and finally, deriving conclusive insights and recommendations for further improvements. The methodology consists of four steps: measure the UX of Design A (Control), develop Design B (Variant), conduct system testing that includes A/B testing, Maze design, and calculate the SUS; collect the test results; and perform the analysis.

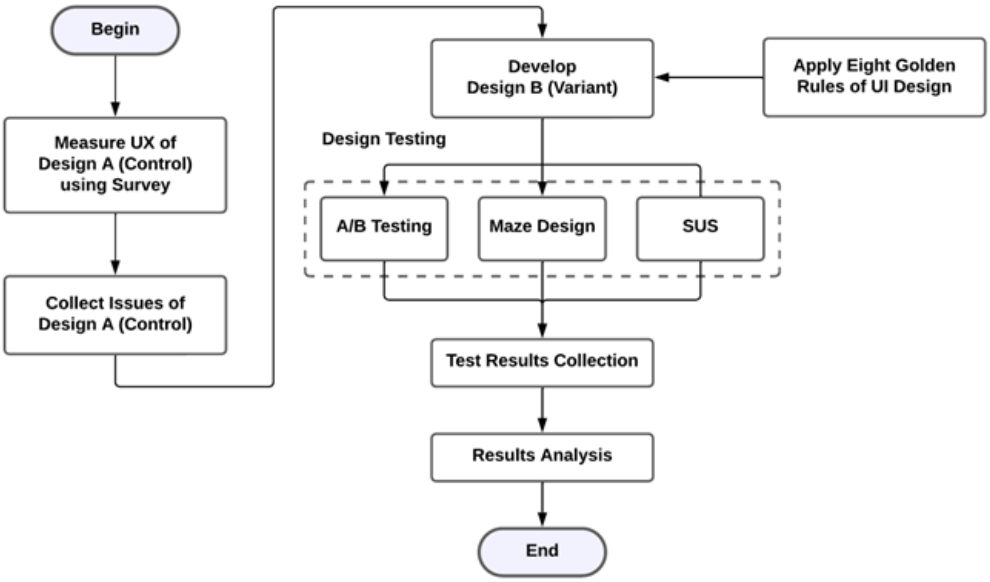


Figure 1. Flowchart for improving the UI/UX of the student portal using the eight golden rules method

In the first step, the UX of Design A (Control) is measured using the SUS questionnaire survey to collect the existing issues. The survey is to identify issues with Design A (Control) through field observations by distributing questionnaires to users of the ITD Adisutjipto Student Portal website UI. A quantitative method is used to collect numerical data. The next step is to develop Design B (Variant), which is different from Design A (Control). The development of Design B (Variant) involves changes to several UI elements, including color, size, layout, and text. For example, if Design A (Control) uses a blue color for the main button, Design B

(Variant) might use green to assess its impact on user interaction. This study follows the Eight Golden Rules of UI Design to ensure that both designs remain intuitive and consistent. Once Design B (Variant) was completed, we collected data on user interactions with each Design, including results, click error rates, average duration, and satisfaction levels. Analyzing this data determines whether Design B (Variant) improves usability and user satisfaction compared to Design A (Control).

The next step is System Testing, where the two Designs will be tested using A/B testing, measured with the SUS, and the Maze Design to determine which one is more effective and user-friendly in achieving the set objectives [8]. The representative final model is established by applying A/B Testing. Previous research has shown that A/B Testing effectively improves product performance by refining the UI. Through A/B Testing, it is possible to analyze which visual elements are more effective in achieving specific goals. This method is combined with SUS as a questionnaire instrument. A/B Testing compares two variations of elements in an application or website to assess their effectiveness in achieving specific objectives, such as increasing conversions or usage. In UI development, A/B Testing determines which interface version is more effective in enhancing the UX. The purpose of using this instrument in the research is to measure the effectiveness of two versions of a website UI using the SUS questionnaire. In A/B Testing, the two different designs or variations were tested simultaneously with users to determine which Design of the Student Portal website UI is more effective and user-friendly [8]. This method enables the direct and objective testing of various designs. Based on the system and interface evaluation conducted for the application, it can be concluded that it has achieved a status that aligns with the expected functions and is in line with the Eight Golden Rules of UI Design. The stages of using A/B testing to develop the UI of the ITD Adisutjipto Student Portal website are as follows: Identification of Variables: Determine the UI elements to be tested, such as color, layout, font size, or button position. Design Creation: Create different variations based on the variables to be tested, adhering to the Eight Golden Rules of UI Design principles. Data Collection: Collect data through surveys using the SUS Questionnaire. Data Analysis: Analyze the collected data to determine which Design is more effective based on the established criteria. Testing: Test both designs (control and variant) with a predetermined number of respondents.

2.1. User Interface/User Experience (UI/UX)

UI is essential for bridging the communication gap between humans and computers or computer-based systems. UI forms are displayed on the computer screen so that humans can understand them, and they help to pass on human commands to be done by the computer [23]. UI can take various forms, and its designation depends significantly on these forms. UI for universities differs from UI for airlines or oil and gas companies. Similarly, the UI for a personal website must be different from the UI for a community or corporate website. As part of Human-Computer Interaction (HCI) technology and the development of information technology, various UIs have been created in the form of hardware and software. Even the UI uses touchscreen technology, which was introduced in the 1960s and was used by Apple in 2007 on its smartphones. A UI is also made to receive voice commands [24] and human finger or palm movements. Different types of UIs are a means of communicating with computers most efficiently and effectively possible.

On the other hand, the UI will only be considered complete if it is accompanied by a positive perception from the user when in use. This perception is obtained from experiences operating the UI according to the facilities used and measured through UX. User experiences in using the UI can be poured into the form of cognitive experience, ergonomic experience, psychological experience, or emotional experience [23]. A UI that is designed by paying attention to the needs or desires of consumers will increase their liking of using it, increase work productivity due to the speed and ease of facilities provided, speed up work completion, and provide effective access to computers, so that it will positively improve the UX of the UI. So the UI that provides a great UX for users is the one that pays attention to the functions needed to access the computer, the arrangement of the placement of UI elements on the computer display, the setting of the appearance of UI elements that support efficient and effective interaction with the computer, the ease of finding UI elements on the computer display, and the informative and interactive UI elements [20, 21].

Several case studies highlight successful UI/UX improvements in the academic world, including helping students learn sensor sensing mechanisms and invisible transducers [20], assessing student performance [19], e-learning using gaming approach [21] and making it easier for students to understand computational physics and chemistry [25]. On the other hand, some facilities are indispensable to students, especially those related to academic support, such as the academic portal, which helps them with their lectures. This part is often overlooked but serves as the spearhead of university academic services. It is not easy to find research on the development of student academic portals, including improving the UI of academic portals to enhance UX for not only their primary users, namely students, but also to bring a positive perception to university services [26].

The questionnaires to assess the user satisfaction with the ITD Adisutjipto Student Portal website UI uses SUS. The categories of the SUS questionnaire are shown in Table 1. In contrast, Table 2 presents a sample of 45 respondents (29 males and 16 females), collected through Google Forms, comprising students and staff with experience using the ITD Adisutjipto Student Portal website's UI. This study involves two stages of questionnaire data collection. The last step is to collect and analyze test results. As described

previously, in the first step, the questionnaire involved 41 student respondents from various cohorts of the Informatics Study Program to evaluate Design A (Control). Based on the data collected from the ITD Adisutjipto Student Portal website and the analysis conducted, Design A received a SUS score of 55.0, which falls into the 'OK' category with a grade scale of D. This indicates that Design A (Control) has unsatisfactory usability and requires further development. In the second stage, the questionnaire involved 41 students, 3 ITSC staff responsible for the ITD Adisutjipto Academic Information System, and one non-ITSC staff member to evaluate Design B (Variant) using the SUS.

Table 1. Questionnaires

No.	Category	Question
1.		Does the current Design implement familiar icons and colors to make it easier to access the menu?
2.		I have trouble finding the main menu items, such as Home, Profile, Study Plan, Study Results,
	Visibility & Aesthetics	Grade Transcript, Questionnaire, and Lecture Schedule, that I want to see easily.
3.		Is the information displayed in the user interface clear and easy to understand?
4.		Do you find this user interface design visually appealing?
5.		Is the consistency of the use of language and terms in the application well maintained?
6.	Consistency & Aesthetics	Does the application's Design look unfamiliar and confusing to you?
7.		To what extent do you agree that A/B design shows consistency in the presentation of information?
8.		Does it take longer to get used to the current website design?
9.	Memorability & Efficiency	To what extent do you agree that today's website app design is easy to learn?
10.		To what extent do you feel that the composition and arrangement of these design elements is so bad?

Table 2. Respondents

Gender	Total	%
Student		
Male	26	63.41%
Female	15	36.59%
Total	41	100%
Employee		
Male	3	75%
Female	1	25%
Total	4	100%

2.2. User Interface (UI) Design Method

The focus was to design the UI for Design B (Variant) using the Eight Golden Rules of UI Design [7] to ensure the quality and effectiveness of the resulting interface. The process began with user research to understand user needs and preferences, followed by

sketching and prototyping to visualize the initial design. Usability testing was then conducted to evaluate the comfort and efficiency of use, followed by design iteration to make improvements based on user feedback. The goal was to create an intuitive and user-friendly interface that meets user expectations.

2.3. User Interface (UI) Design Components

Designing a UI involves creating an intuitive and effective interface for applications or systems, focusing on visual aspects and style to enhance usability and user enjoyment. A design system, illustrated in Figures 2, 2, 3, 4, 5, consists of reusable design components that maintain high-quality and consistency standards. UI/UX Designers leverage these components to ensure more consistent design outcomes and streamline the design process. By utilizing existing assets, designers avoid recreating elements and minimizing design changes [23], simplifying collaboration within larger teams and promoting a more efficient design workflow.

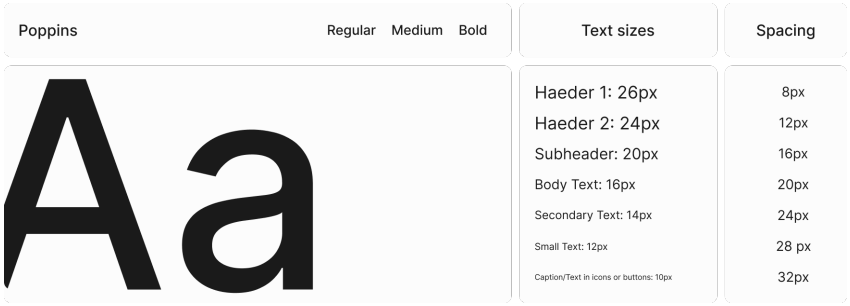


Figure 2. Typography

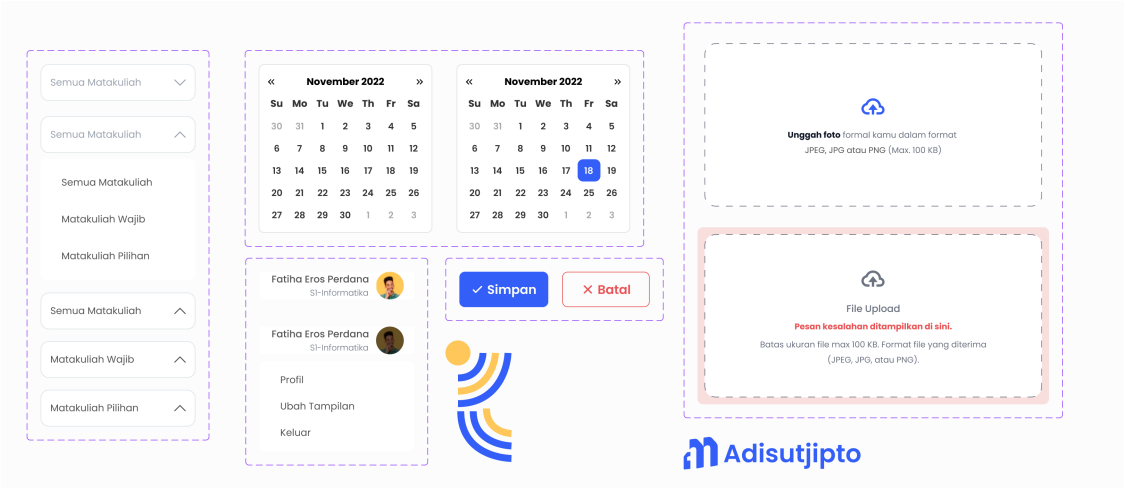


Figure 3. Design components

Figure 4. Iconography (source: heroicons.com)

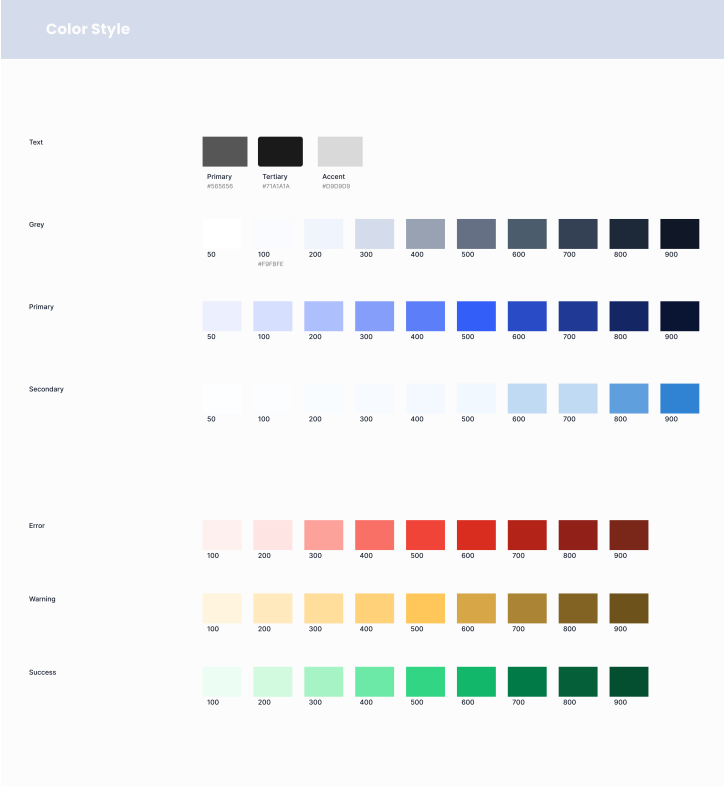


Figure 5. Color palette

2.4. UI Prototype

The prototype in Figure 6 represents a UI for the ITD Adisutjipto Student Portal, specifically in Design B (Variant). This prototype has been meticulously crafted to visualize and evaluate the preliminary concept of the new UI planned for future implementation. Its primary purpose is to serve as a tool for gathering student feedback before the full-scale rollout of the final Design. By engaging with this prototype, students can offer valuable insights and suggestions, which facilitates identifying areas that require refinement. This iterative feedback loop ensures that the final Design aligns closely with user needs and expectations, ultimately leading to a more effective and user-centered interface [16].

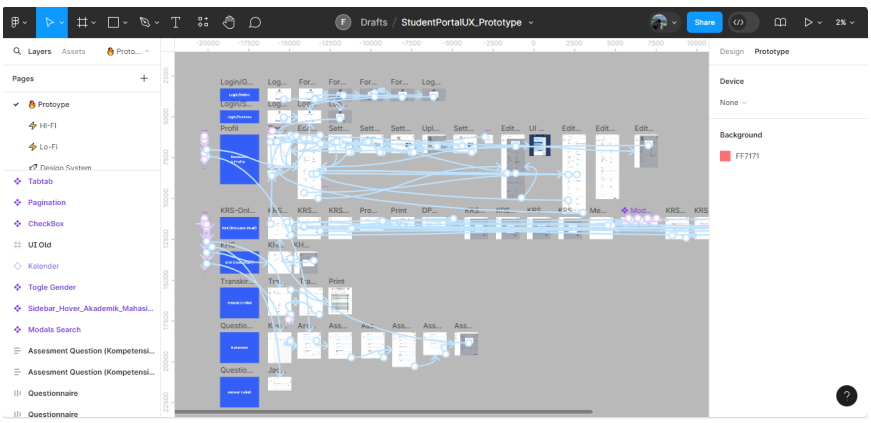


Figure 6. Design B (Variant) prototype

2.5. UI Improvement Method using the Eight Golden Rules of User Interface Design

The Eight Golden Rules of UI Design, introduced by [7] in 1986, these were fundamental principles that guided the creation of user-friendly interfaces. There are also several golden rules available from different creators with their perspectives, such as interface design based on usability principles [8], and framework introduced that consists of five primary concepts [22]. In our research, we opted for the Eight Golden Rules method due to its timelessness, as many UI designers still use it to guide the development of a usable and interactive UI. The guidance has rules that advocate the UI designers to be consistent with their choice of UI elements and processes from the beginning to the end, to develop a universal UI that can be understood by any user, including the ones with special needs, to be informative with simple instructions how to use the UI facility, to avoid errors caused by the users because, and to give the user a pleasure of using the UI because of seamless interaction that can make them remember any facility provided.

A study showed that adhering to these principles can significantly enhance the UX by making interfaces more intuitive and responsive [18]. These rules were used to analyze the video conference interface [24], farming application [27], a food-sharing application through Android system [28], mobile learning, and for web assessment [29]. The Eight Golden Rules method guides UI development and provides an evaluation tool to ensure the developed UI can fulfill user needs. In this research, we applied the Eight Golden Rules of UI Design to enhance the ITD Adisutjipto Student Portal UI, aiming to improve the students' experience to a higher level.

2.6. Improved UI Testing Method using A/B Testing

A/B Testing is one of the usability testing techniques for software that is useful for comparing two designs of an application or website to determine which design is more effective in achieving specific goals. A/B testing is a method that uses two versions of a website to compare and identify the superior one, as shown in Figure 7. However, in this case, the A/B testing method requires a questionnaire to measure the usability of the ITD Adisutjipto Student Portal website UI product. This study will use the SUS to measure the usability level of a design, system, or equipment. According to the International Organization for Standardization-ISO 9241-110:2020, usability is the degree to which specified users can use a product to achieve specified goals effectively, efficiently, and satisfactorily [30].

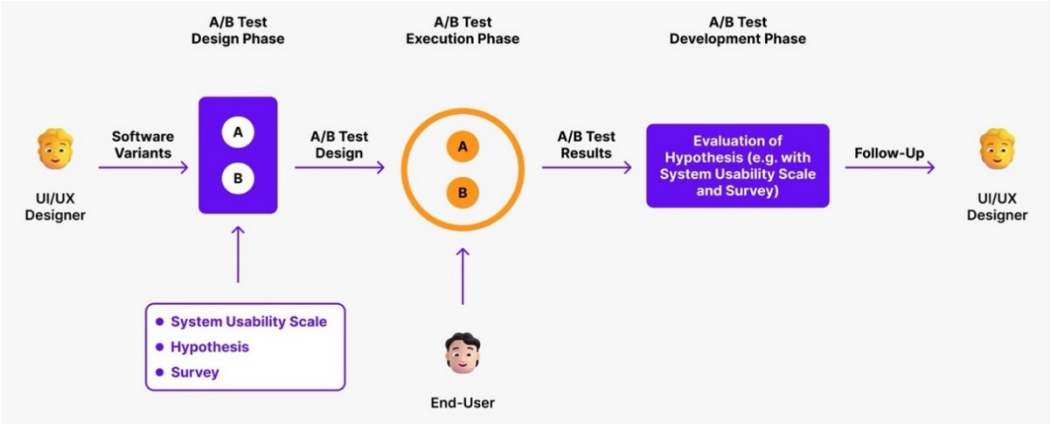


Figure 7. A/B Testing Scheme

2.7. UI Usability Measurement using System Usability Scale (SUS)

The SUS is a widely used tool for assessing the usability of a system and provides a reliable measure of usability across various artificial creations from industrial perspectives, such as the health industry, which is currently a trend [31] that can be systems, tools [32, 33], equipment, interfaces [34, 35], software applications [36] ranges from simple games to websites [37] up to mobile applications [38–40] and related. Usability can be interpreted as an artifact's ability to support specific needs effectively. For this reason, the user's perspective is an essential key in assessing usability. The use of SUS aims to commodify human subjectivity as a user and convert it into a quantitative measure, thereby transforming it into an objective value that represents the comprehensive view of many users toward the usefulness of a single artifact.

In the context of this study, SUS is used to measure the usability of a Student Portal UI design, namely design B (Variant), to assess the improvements that have been made in the face of the current Design, namely design A (Control) from perspectives such as facility effectiveness, ease of operation, efficient use of resources, response speed, and satisfaction in using it. Therefore, capturing user feedback makes it a valuable resource for identifying areas of improvement in UI design. The SUS score is calculated by using Equation 1, as shown in the steps outlined in Figure 8. The components of SUS measurement are $\bar{x}$ is the mean score, Σx is the total SUS score, n is the number of respondents. $\bar{x}$ is obtained from the accumulated value of all x variables divided by the number of respondents. The total SUS score is obtained by applying the following rules [22, 31]. For odd-numbered questions, namely 1, 3, 5, 7, and 9, their scores will be subtracted by 1. The odd-numbered questionnaire SUS score is obtained using the formula $\Sigma P_x - 1$, where P_x is the total sum of the odd-numbered questionnaires. On the other hand, for even-numbered questionnaires, namely scores 2, 4, 6, 8, and 10, the score is obtained by subtracting the total sum of the even-numbered questionnaires from value 5. The even-numbered questionnaire SUS score is obtained using the formula $\Sigma 5 - P_n$, where P_n is the total sum of even-numbered questionnaires. The SUS score is obtained from the sum of the scores of each question which is then multiplied by 2.5 to get a range of values between 0-100 by using the formula $\Sigma P_x - \Sigma P_n * 2.5$. After getting the score from each respondent, the next step is to calculate the average score (Figure 8). The method involves totaling the scores and then dividing them by the total number of respondents. Here is an example of calculating the score using the SUS method [22–24, 27–31]. $SUS_{score} = ((Q_1 - 1) + (5 - Q_2) + (Q_3 - 1) + (5 - Q_4) + (Q_5 - 1) + (5 - Q_6) + (Q_7 - 1) + (5 - Q_8) + (Q_9 - 1) + (5 - Q_10) * 2.5)$.

$$\bar{x} = \frac{\Sigma x}{n} \tag{1}$$

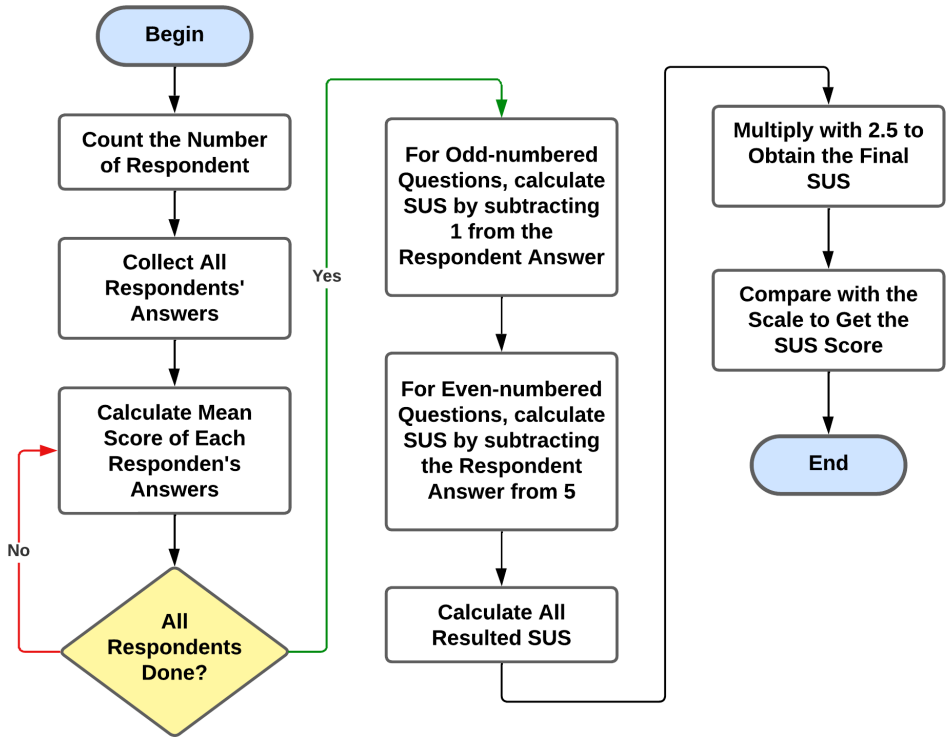


Figure 8. Steps to Obtain SUS Score

The scoring rules apply to one respondent. For other respondents, the SUS score for each participant is calculated by finding the average, which involves summing all the scores and dividing by the number of respondents. Generally, the criteria for SUS scores, as illustrated in Figure 9, are as follows. A score of 0-50 means the system or product has low user satisfaction and requires immediate improvement; a score of 51-70 means the system or product currently has adequate user satisfaction but there is room

for improvement; a score 71-85 means the system or product has a satisfying level of user satisfaction, though some improvements are still needed, and a score of 86-100 means the system or product receives a highly satisfactory user rating with little room for improvement.

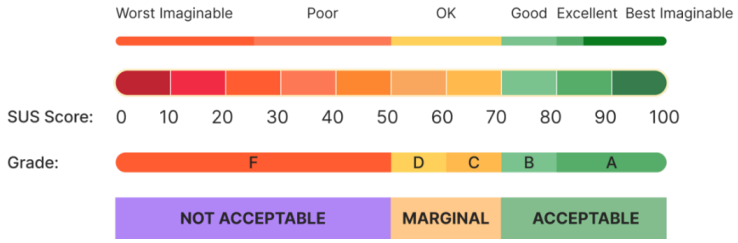


Figure 9. SUS Measurement

SUS will collect data on users' perceptions of the usability of the two tested designs, which will help developers improve the website application or system. The testing and evaluation will utilize the Eight Golden Rules of UI Design as fundamental principles. In this testing, each principle will be tested using A/B Testing methods. For example, the principle "Strive for Consistency" can be tested by creating variations in color, button size, and text within the application or website. To obtain user satisfaction ratings for the website UI, we used the SUS questionnaire [41] after combining A/B Testing methods and the Eight Golden Rules of UI Design [28]. On the other hand, the A/B Testing method can be used for UI development [42] using a solid foundation from the Eight Golden Rules of UI Design. These rules have been thoroughly tested and proven effective in creating a robust and functional interface.

3. RESULT AND ANALYSIS

The ITD Adisutjipto Student Portal UI development involves a rigorous process incorporating A/B Testing and the SUS to refine and improve the interface design. A/B Testing is employed to compare two different versions of the interface design, allowing for a detailed evaluation of each version's performance metrics and user preferences. This approach helps determine which design variant delivers a better UX and aligns more closely with user expectations. Simultaneously, the SUS is utilized to assess the usability of the revised interface based on user feedback. SUS provides a standardized measure of the interface's effectiveness, ease of use, and overall satisfaction from the end users' perspective. Combining these methodologies ensures the final design is functional and user-friendly before proceeding to full-scale implementation. Figure 10 illustrates Design A (Control), which represents the existing version of the Student Portal UI. This design incorporates essential components, including the login page, dashboard, user profile, study plan card, study result card, transcript, questionnaire, and class schedule. By comparing this existing Design with the new variations through A/B Testing and evaluating usability with SUS, the goal is to identify and implement improvements that better meet user needs and expectations.

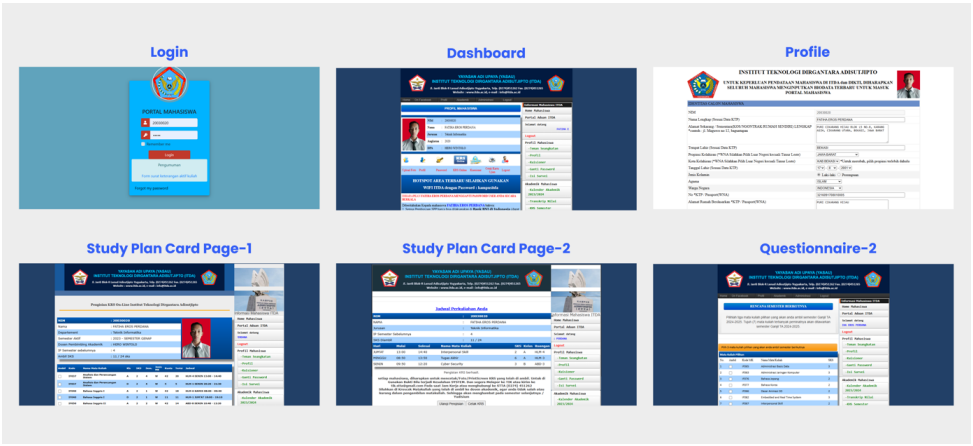
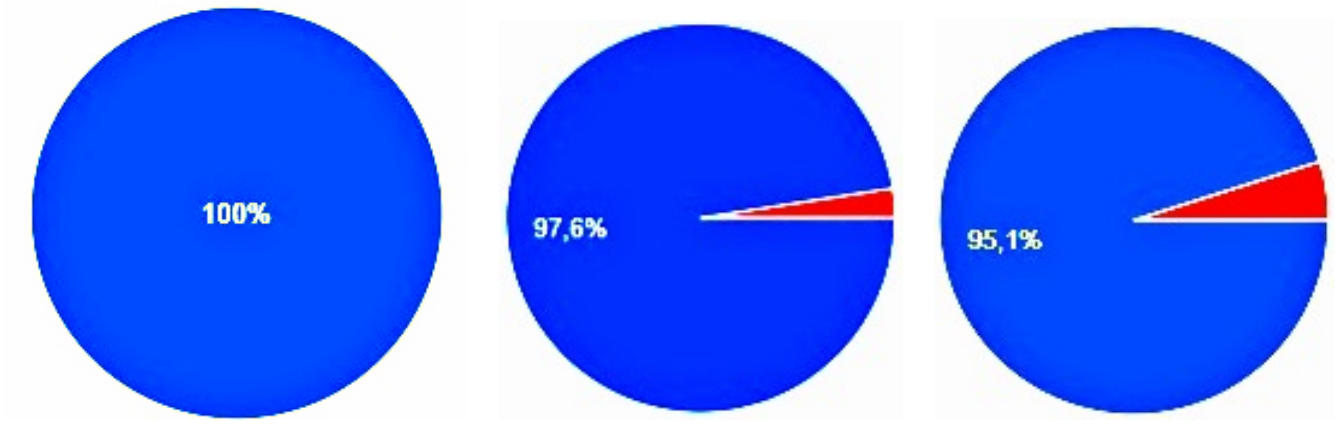


Figure 10. Design A (Control) of the existing Student Portal UI

Previously, a survey was conducted to assess the perception of ITD Adisutjipto student users, a sample of 41 student respondents from the Informatics Study Program, regarding their experience using the Student Portal. The total number of respondents should be 47 students from the 2019 and 2020 classes, but only 41 students, or 87.2% of the population, participated in the assessment. Additionally, responses were also gathered from staff users to provide further perspective. Four staff users were selected, namely all ITSC staff, as many as three persons or 100% of the population 11(a), and one regular or non-ITSC staff member to ensure that the proposed Student Portal is better than the current one. The survey was conducted from February to March 2024 using Google Forms, focusing on three key questions related to improving the design of the Student Portal's UI/UX, as presented in Table 3. The survey results show that 97.6% of respondents 11(b) stated that there is a need to improve the UI design of the Student Portal, specifically in terms of color components, layouts, text, and other elements. According to the survey results, 95.1% of respondents 11(c) agreed with the evaluation of several important UI elements, including the selection of colors, fonts, icons, buttons, and layouts, which aim to improve the experience and usability. Therefore, based on the preliminary survey, we focus our research on improving the ITD Adisutjipto Student Portal UI performance, with the hope that our research results can serve as lessons learned for other higher-education institutions in Indonesia in developing better Student Portal UIs.

Table 3. Survey Questions

No.	Question	Results (%)
1.	Do you know about the ITD Adisutjipto Student Portal website?	100
2.	Do you agree that the ITD Adisutjipto Student Portal was improved in design?	97.6
3.	Do you agree that menus such as Home, Profile, Study Plan, Study Results, Transcripts, Questionnaires, and Lecture Schedules should be evaluated?	95.1



(a) Result of Question 1 (b) Result of Question 1 (c) Result of Question 2

Figure 11. Graph representation for the survey results

3.1. Design B (Variant) Testing

Since the release of the ITD Adisutjipto web-based student portal, no research has been conducted on its usability evaluation for development and improvement. It leaves some usability issues unknown, making usability testing necessary for the portal. Table 4 shows the results of usability testing related to the design of the student portal service. The average outcome for the UI components was "Direct Success." The application testing was divided into two parts. First, the evaluation of design B (Variant) using Maze, which was based on the principles of the Eight Golden Rules of UI Design. The second part involved implementing the SUS questionnaire to measure the usability of the revised design based on user feedback. This comprehensive approach allowed for a thorough assessment of both functional performance and user satisfaction. The usability test results for design B (Variant), using the Eight Golden Rules of UI Design, obtained an average score of 75.0, placing it in the "GOOD" category with an adjective rating of B. In comparison, the previous portal version, design A (Control), scored an average of 55.0, placing it in the "OK" category with an adjective rating of D.

Table 4. Maze test results

Component	Task	Outcome	Misclick Rate (%)	Average Duration (second)
Login Page	Performing login	Direct Success	0	6.6
Header	Changing UI appearance	Direct Success	0	5.8
Dashboard Page	Editing profile and uploading profile photo	Direct Success	0	26.3
Profile Page	Editing profile	Direct Success	0	12.3
Study Plan Card Page	Selecting courses and confirming with the Study Success Supervisor or Academic Supervisor	Direct Success	23.1	37.3
Study Result Card Page	Checking grade details	Direct Success	0	10.4
Transcript Page	Printing transcript	Direct Success	0	6.1

3.2. SUS Questionnaires for UI Testing

The SUS Questionnaire results are used to assess the usability of the improved UI. The SUS measures [22–24, 27–31] user satisfaction by administering a simple questionnaire to respondents after using or testing the application's usability. This testing is conducted upon completion of Design B (Variant). The questionnaire consists of 10 items in the form of questions, each with a 5-point scale: Strongly Disagree (SD), Agree (A), Disagree (D), Strongly Agree (SA), and Unsure (U). Here, SD represents the highest point, with a score of 5. Table 5 and Table 6 show the SUS questionnaire for the two designs, Design A (Control) and Design B (Variant).

Table 5. SUS Questionnaire for Design A (Control)

No.	Code	Question
		Visibility and Aesthetics
1.	Q1	Has the current Design implemented familiar icons and colors to facilitate menu access?
2.	Q2	I need help finding the main menu items, such as Home, Profile, Study Plan, Study Results, Grade Transcript, Questionnaire, and Class Schedule, that I want to access easily.
3.	Q3	Is the information displayed in the user interface clear and easy to understand?
4.	Q4	Do you find the current user interface design visually appealing?
		Consistency and Aesthetics
5.	Q5	Is the consistency in language usage and terminology maintained well within the application?
6.	Q6	Does the application's Design feel unfamiliar and confusing to you?
7.	Q7	To what extent do you agree that the A/B Design consistently presents information?
		Memorability and Efficiency
8.	Q8	I need more time to get used to the current website design.
9.	Q9	To what extent do you agree that the current website design is easy to learn?
10.	Q10	To what extent do you disagree that the composition and arrangement of design elements could be better?

Table 6. SUS Questionnaire for Design B (Variant)

No.	Code	Question
		Visibility and Aesthetics
1.	Q1	Do you agree that the current design utilizes icons, colors, layout, and other less familiar elements to facilitate menu access?
2.	Q2	Is the information displayed in the user interface clear and easy to understand?
3.	Q3	Do you find the user interface design visually appealing?
		Consistency and Aesthetics
4.	Q4	Is the consistency of language and terminology usage maintained well in the application?
5.	Q5	To what extent do you agree that the A/B Design consistently presents information?
		Memorability and Efficiency
6.	Q6	Does it take longer to get used to the current website design?
7.	Q7	To what extent do you agree that the current website design is easy to learn?
		Error Handling
8.	Q8	Is it easy to understand the error messages that appear when using this website's Design?
		Flexibility
9.	Q9	How much do you agree that this website design is easy to use?
		Accessibility
10.	Q10	How easily can you access all features on the current website design?

3.3. Recapitulation of Design A (Control) Questionnaire Results

The initial step involved gathering feedback from the user population students at the ITD Adisutjipto regarding the existing or current student portal design (Design A/Control) before Design B (Variant) of the student portal was developed; the questions were based on the principles of the Eight Golden Rules method, which serve as a guideline for UI design, as shown in Table 4. These principles include Visibility and Aesthetics, Consistency and Aesthetics, Memorability and Efficiency, Error Handling, and Flexibility and Accessibility. A total of 10 questions were created, each with responses rated on a scale from 1 to 5: Strongly Disagree (1), Disagree (2), Undecided (3), Agree (4), and Strongly Agree (5). The results of the questionnaire for Design A (Control) are presented in Table 7.

Table 7. SUS Questionnaire Results for Design A (Control) from Students' View

Respondents	Questionnaire Results									
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
R1	3	4	3	3	3	4	3	3	3	3
R2	2	3	3	4	3	2	2	4	2	3
R3	3	3	3	2	3	3	3	4	3	3
R4	5	3	3	2	3	2	5	3	3	3
R5	5	3	2	1	2	3	3	3	3	3
R6	5	5	4	1	4	4	5	3	2	2
R7	5	3	4	4	5	3	3	2	4	5
R8	5	4	4	1	4	2	2	2	4	4
R9	5	3	3	2	3	3	3	2	4	4
R10	5	2	4	2	3	2	3	3	4	3
R11	4	4	2	2	4	4	4	4	3	3
R12	3	3	3	3	3	3	3	3	3	3
R13	4	2	4	3	4	4	4	3	4	3
R14	4	2	4	2	4	2	4	4	4	4
R15	5	4	2	2	3	4	5	4	2	2
R16	4	5	4	5	5	5	4	3	5	5
R17	5	4	4	2	3	4	5	4	2	4
R18	5	4	4	1	3	3	3	3	3	4
R19	3	4	3	2	4	5	4	4	2	4
R20	5	2	3	1	5	3	4	5	2	4
R21	4	3	5	2	3	3	5	4	3	4
R22	3	4	3	2	5	2	4	2	3	3
R23	3	1	5	3	5	1	3	4	3	1
R24	5	3	3	2	3	2	3	2	4	3
R25	5	5	1	1	4	4	4	1	5	5
R26	4	3	3	4	4	3	4	4	4	3
R27	5	5	1	1	1	5	5	5	1	1
R28	4	4	4	3	4	2	5	5	4	2
R29	1	4	3	1	3	4	5	3	2	4
R30	1	4	3	3	3	4	3	3	3	4
R31	1	2	2	1	4	4	3	4	2	1
R32	1	5	1	1	1	5	5	5	1	1
R33	1	5	5	5	4	3	3	4	5	5
R34	4	3	3	4	4	4	4	3	3	1
R35	5	3	3	3	3	3	5	3	3	3
R36	2	4	4	3	3	3	3	3	3	3
R37	4	4	4	4	4	4	4	4	4	4
R38	3	3	3	1	3	3	3	1	5	3
R39	5	2	4	3	4	2	3	2	2	3
R40	1	2	2	1	4	3	5	3	2	2
R41	5	3	3	2	4	3	4	2	3	3

3.4. Recapitulation of Design B (Variant) Questionnaire Results

The collected data was meticulously compiled and analyzed after the respondents were instructed to complete the 10-item SUS questionnaire in Table 5 via Google Form. The summary and recapitulation of the data obtained from this testing phase for Design

B (Variant) are presented in Table 8. The table provides a detailed overview of the responses, offering insights into the usability and effectiveness of Design B (Variant) based on the feedback gathered from the respondents. The recapitulation includes statistical analyses, response distributions, and notable trends or patterns observed during testing. These are crucial for assessing the overall UX and identifying areas for potential improvement in the Design.

Table 8. SUS Questionnaire Results for Design B (Variant) from Students' View

Respondents	Questionnaire Results									
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
R1	5	3	5	3	4	1	5	3	5	4
R2	5	1	5	4	5	1	5	3	5	2
R3	4	1	4	4	5	2	5	3	4	2
R4	5	1	5	3	5	1	5	4	5	2
R5	5	2	3	4	5	2	4	4	5	2
R6	4	2	3	4	5	2	4	4	4	3
R7	5	1	3	4	5	2	5	2	5	1
R8	4	1	4	4	4	1	4	4	4	4
R9	5	2	4	2	5	3	5	1	4	3
R10	4	2	5	4	5	1	4	4	5	2
R11	4	3	4	4	5	1	4	3	4	4
R12	5	1	5	4	5	1	5	2	5	3
R13	4	3	4	4	4	1	4	4	4	4
R14	4	2	3	3	5	3	3	4	4	2
R15	5	1	3	3	5	2	5	2	5	3
R16	5	2	4	4	5	2	4	4	5	4
R17	3	3	3	3	4	1	5	3	3	3
R18	4	1	3	3	4	1	5	2	5	2
R19	4	1	5	3	4	2	5	3	4	3
R20	5	2	5	3	4	1	5	4	4	2
R21	4	2	5	4	4	2	4	4	4	2
R22	4	2	5	4	3	2	4	3	5	3
R23	4	1	5	3	5	2	4	3	5	2
R24	4	1	5	4	5	2	5	3	5	2
R25	5	2	3	3	4	3	3	2	3	4
R26	5	1	5	1	5	1	3	3	5	3
R27	2	2	5	2	4	1	5	4	4	3
R28	5	3	4	4	5	1	5	3	4	2
R29	5	1	5	3	5	1	5	2	5	2
R30	5	2	5	3	5	2	5	3	5	3
R31	3	3	4	3	4	1	3	2	4	1
R32	5	2	5	3	5	1	4	3	4	3
R33	4	1	5	3	5	2	4	1	4	3
R34	4	1	3	3	4	1	4	3	4	1
R35	5	2	5	3	5	2	5	3	5	2
R36	4	2	4	3	5	2	4	3	4	3
R37	4	2	5	4	5	2	4	3	4	3
R38	4	2	5	3	5	2	5	2	4	3
R39	4	2	5	3	5	1	4	2	5	3
R40	5	1	5	3	5	2	5	4	5	1
R41	4	1	5	3	5	1	5	3	4	3

Table 9. SUS Questionnaire Results for Design B (Variant) from Staff's View

Respondents	Questionnaire Results									
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
R42	4	3	3	3	5	2	5	2	5	3
R43	5	2	4	3	5	2	4	3	5	2
R44	5	3	4	2	5	1	5	3	4	3
R45	4	2	4	3	5	1	4	3	4	2

Based on the data presented in Tables 8 and 9, responses for Design B (Variant) were collected from a total of 45 respondents, encompassing a diverse range of feedback. This data will be analyzed using the formula provided by the SUS to assess the usability and effectiveness of the Design. Of the 45 respondents, 41 are students, while the remaining four are staff of ITD Adisutjipto, including both CTSI and non-CTSI staff. This composition of respondents allows for a comprehensive evaluation from primary user groups and other stakeholders, ensuring a well-rounded analysis of the Design's usability across different user demographics.

3.5. Questionnaire Results Analysis

The final step is to process and analyze the data collected in the previous stages. The data will be analyzed after the Respondent's answers are summarized. The analysis of the questionnaire data using SUS [22–24, 27–31] will be conducted using the established SUS formula in Equation 1. The scoring rules apply to one Respondent. For multiple respondents, the SUS score for each participant is calculated by finding the average, which involves summing all the scores and dividing by the number of respondents.

3.6. Analysis of SUS Questionnaire Results for Design A (Control)

The results of the analysis are presented in Table 10. This table presents detailed data on the scores obtained from the SUS questionnaire results for Design A (Control), including the individual scores of each Respondent, the average score, and the interpretation of the usability quality of the Design. This analysis provides in-depth insights into how well Design A (Control) meets the usability standards measured by the SUS questionnaire. Based on the analysis conducted on the questionnaire results for Design A (Control), the obtained SUS score is 55.0. This score falls into the 'OK' category, with a grade scale of D. The score indicates that Design A (Control)'s usability is not very satisfactory, and that further development of the portal website's UI is needed.

Table 10. SUS Calculation Results for Design A (Control)

Respondents	Questionnaire Results										Total	SUS Score
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10		
R1	2	1	2	2	2	1	2	2	2	2	18	45.0
R2	1	2	2	1	2	3	1	1	1	2	16	40.0
R3	2	2	2	3	2	2	2	1	2	2	20	50.0
R4	4	2	2	3	2	3	4	2	2	2	26	65.0
R5	4	2	1	4	1	2	2	2	2	2	22	55.0
R6	4	0	3	4	3	1	4	2	1	3	25	62.5
R7	4	2	3	1	4	2	2	3	3	0	24	60.0
R8	4	1	3	4	3	3	1	3	3	1	26	65.0
R9	4	2	2	3	2	2	2	3	3	1	24	60.0
R10	4	3	3	3	2	3	2	2	3	2	27	67.5
R11	3	1	1	3	3	1	3	1	2	2	20	50.0
R12	2	2	2	2	2	2	2	2	2	2	20	50.0
R13	3	3	3	2	3	1	3	2	3	2	25	62.5
R14	3	3	3	3	3	3	3	1	3	1	26	65.0
R15	4	1	1	3	2	1	4	1	1	3	21	52.5
R16	3	0	3	0	4	0	3	2	4	0	19	47.5
R17	4	1	3	3	2	1	4	1	1	1	21	52.5
R18	4	1	3	4	2	2	2	2	2	1	23	57.5
R19	2	1	2	3	3	0	3	1	1	1	17	42.5
R20	4	3	2	4	4	2	3	0	1	1	24	60.0
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
R37	3	1	3	1	3	1	3	1	3	1	20	50.0
R38	2	2	2	4	2	2	2	4	4	2	26	65.0
R39	4	3	3	2	3	3	2	3	1	2	26	65.0
R40	0	3	1	4	3	2	4	2	1	3	23	57.5
R41	4	2	2	3	3	2	3	3	2	2	26	65.0
Average Score (Results)												55.0

3.7. Analysis of SUS Questionnaire Results for Design B (Variant)

Table 11 presents detailed data from the questionnaire results on the SUS scores for Design B (Variant), including individual scores and total scores. The questionnaire responses were collected from 41 student users and 4 non-ITSC staff members, totaling 45 respondents. This analysis provides in-depth insights into how well Design B (Variant) meets the usability standards measured by the SUS Questionnaire. Based on the analysis conducted for Design B (Variant). a SUS score of 75.0 was obtained. This score falls into the GOOD category with a grade scale of B, meaning that the new Design received positive user feedback. The score indicates that most users were satisfied with the provided interface, found the navigation intuitive, and encountered no issues while using the application. In other words, Design B (Variant) is considered adequate, efficient, and satisfactory in supporting user needs on the ITD Adisutjipto Student Portal website UI. The new UI, Design B (Variant), is illustrated in Figure 12, which comprises the login page, dashboard, profile, study plan card, study result card, transcript, questionnaire, and class schedule.

Table 11. SUS Calculation Results for Design B (Variant)

Respondents	Questionnaire Results										Total	SUS Score
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10		
R1	4	2	4	2	3	4	4	2	4	1	30	75.0
R2	4	4	4	1	4	4	4	2	4	3	34	85.0
R3	3	4	3	1	4	3	4	2	3	3	30	75.0
R4	4	4	4	2	4	4	4	1	4	3	34	85.0
R5	4	3	2	1	4	3	3	1	4	3	28	70.0
R6	3	3	2	1	4	3	3	1	3	2	25	62.5
R7	4	4	2	1	4	3	4	3	4	4	33	82.5
R8	3	4	3	1	3	4	3	1	3	1	26	65.0
R9	4	3	3	3	4	2	4	4	3	2	32	80.0
R10	3	3	4	1	4	4	3	1	4	3	30	75.0
R11	3	2	3	1	4	4	3	2	3	1	26	65.0
R12	4	4	4	1	4	4	4	3	4	2	34	85.0
R13	3	2	3	1	3	4	3	1	3	1	24	60.0
R14	3	3	2	2	4	2	2	1	3	3	25	62.5
R15	4	4	2	2	4	3	4	3	4	2	32	80.0
R16	4	3	3	1	4	3	3	1	4	1	27	67.5
R17	2	2	2	2	3	4	4	2	2	2	25	62.5
R18	3	4	2	2	3	4	4	3	4	3	32	80.0
R19	3	4	4	2	3	3	4	2	3	2	30	75.0
R20	4	3	4	2	3	4	4	1	3	3	31	77.5
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
R37	3	3	4	1	4	3	3	2	3	2	28	70.0
R38	3	3	4	2	4	3	4	3	3	2	31	77.5
R39	3	3	4	2	4	4	3	3	4	2	32	80.0
R40	4	4	4	2	4	3	4	1	4	4	34	85.0
R41	3	4	4	2	4	4	4	2	3	2	32	80.0
R42	3	2	2	2	4	3	4	3	4	2	29	72.5
R43	4	3	3	2	4	3	3	2	4	3	31	77.5
R44	4	2	3	3	4	4	4	2	3	2	31	77.5
R45	3	3	3	2	4	4	3	2	3	3	30	75.0
Average Score (Results)												75.0

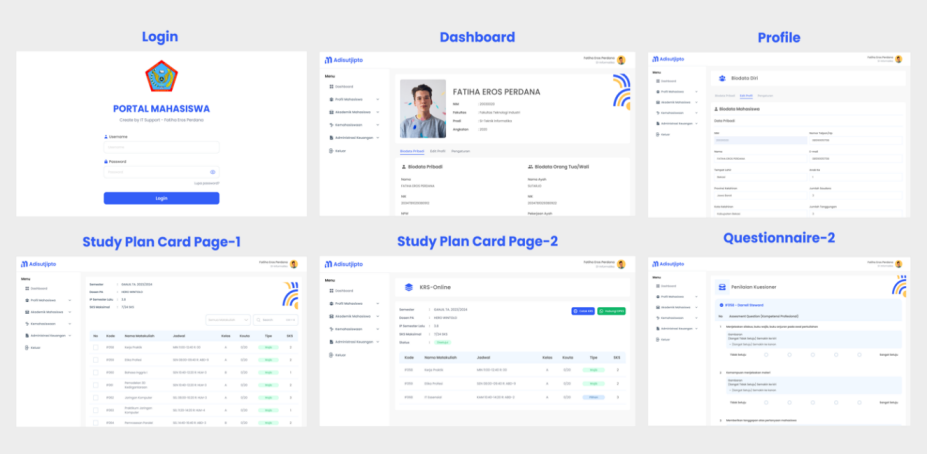


Figure 12. Design B (Variant), the improved Student Portal UI

Based on data collection from the ITD Adisutjipto Student Portal UI and the analysis conducted, a significant difference is observed between the SUS scores of Design A (Control) and Design B (Variant). For Design A (Control), the SUS score obtained is 55.0, which falls into the 'OK' category with a grade scale of D. This indicates that users experience some trouble and dissatisfaction with using the application with this design. Several usability issues previously identified, such as not meeting the principles of visibility and aesthetics (Q1-Q4), consistency and aesthetics (Q5-Q7), memorability and visibility (Q8-Q10), error handling (Q11), flexibility (Q12), and accessibility (Q13), contribute to this. Additionally, inefficient navigation and a lack of visual appeal, such as color, size, layout, and other elements, are significant factors contributing to the low rating. On the other hand, for Design B (Variant), the SUS score obtained is 75.0, which falls into the GOOD category with a grade scale of B as shown in Figure 13. Design B (Variant) has improved the existing ITD Adisutjipto Student Portal UI by 36.4% compared to Design A (Control).

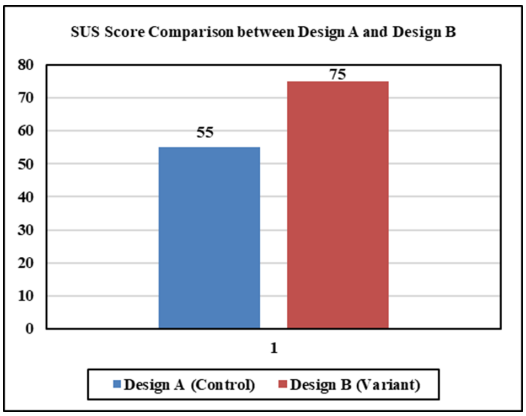
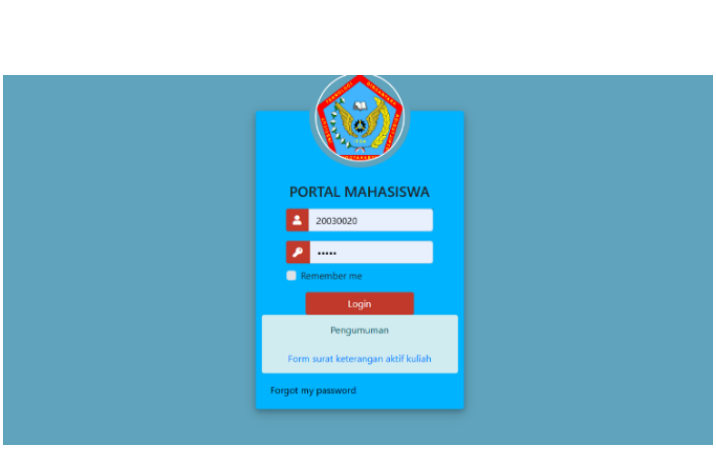


Figure 13. Usability comparison between Design A (Control) and Design B (Variant)

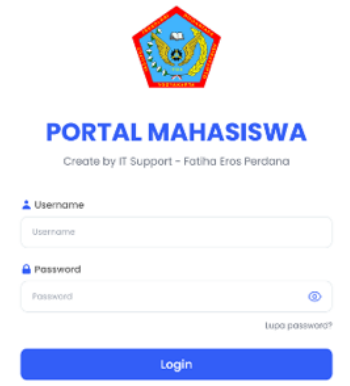
The results in Figure 13 also demonstrate a significant improvement in the application's usability following the implementation of design changes. These improvements focused on navigation, color, font, icons, buttons, and layout. The comparison between SUS scores of Design A (Control) and Design B (Variant) indicates a significant enhancement in the usability of the ITD Adisutjipto Student Portal website UI. Design B (Variant) successfully increased user satisfaction and addressed most of the issues identified in Design A (Control). It demonstrates that the application of design principles in Design B (Variant), based on the Eight Golden Rules of UI Design, has yielded better results. With SUS scores showing a significant difference between Design A (Control) and Design B (Variant), it can be concluded that users prefer Design B (Variant), which provides a more positive experience. Comparing user preferences between these two designs helps identify more effective design elements that can be applied in future UI development. Figure 12 illustrates the improvement of the Student Portal UI by Design B (Variant) in accordance with the Eight Golden Rules of UI Design. Figure 14 shows Design B (Variant)'s improvement over Design A (Control) for the Student Portal landing page UI.

Table 12. Improvement shown by Design B (Variant)

Rules	Design A (Control)	Design B (Variant)	Improvement
Strive for consistency	Not consistent in Button, Color, Text, and Language	Consistent in Button, Color, Text, and Language	Better color selection Clearer text Language selection
Enable frequent users to use shortcuts	Not supported	Provide shortcut	Implementing the shortcut CTRL + K to improve the efficiency of searching for courses Feedback is communicated clearly and is easy to understand.
Offer informative feedback	Less informative feedback	Informative feedback	Sufficient information is provided to explain the context and reasons behind the feedback. Feedback is tailored to the user's context and the specific situation at hand.
Design dialog to yield closure	Less optimal closure	Optimal closure	Displaying a clear message Indicating that a process is in progress Providing options to proceed to the next step Using visual elements, such as check icons or colors, to indicate successful actions Clear messages when errors occur, along with instructions for resolution
Offer simple error handling	Error handling is complex to understand	Provide specific error messages, buttons, or suggestions to address the issue.	Creating user-friendly and relevant copywriting
Permit easy reversal of actions	Lack of usability consideration	Easy reversal of actions	Implementation of options to undo recent actions
Support internal locus of control	It does not provide users with internal control	Give users a sense of control over the system	Customization options for the UI
Reduce short-term memory load	UI and UX overload the user's memory	UI and UX are easy for users to remember	Simple language Clear layout Easy-to-understand visuals Easy-to-remember visuals



(a) Design A (Control), the existing UI



(b) Design B (Variant), the improved UI

Figure 14. UI comparison between Design A (Control) and Design B (Variant)

4. CONCLUSION

Through this research, the development of the current design (Design A) into Design B using the Eight Golden Rules of UI Design has successfully provided a better UX for users of the ITD Adisutjipto Student Portal. This is evidenced by a 36.4% increase in the SUS score, rising from 55.0 in Design A to 75.0 in Design B. This improvement demonstrates the effectiveness of the UI in enhancing the usability of the Student Portal, resulting in a more intuitive, consistent, and user-friendly interface. Indirectly, this research also applies the principles of Human-Computer Interaction (HCI), enabling students and staff to interact with the portal more easily and access information that is more accessible, flexible, and visually appealing. For future research, it is recommended to explore the implementation of UI and UX improvements in other ITD Adisutjipto information systems, such as the Lecturer Portal, Student Affairs, General Administration, and Library portals, to further support the development of accessible, flexible, and visually appealing information systems across a broader institutional scope.

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6. DECLARATIONS

AUTHOR CONTIBUTION

This research is a collaborative effort by all authors, with specific tasks assigned to each. The first author, ADWS, directed the research and supervised the content. He also verified and finalized the article, including revising some Figures. The second author, F.E.P., conducted the preliminary survey to gather the respondents' perspectives as the basis for developing an improved UI/UX and administered the questionnaire to compare the improved UI/UX with the existing one. The last author, D.N., supervised the research and suggested the proper methods for measuring improved UI/UX quality.

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COMPETING INTEREST

There is no competing interest when performing this research, whether from the respondents' or the institution's side. This work is independent and respects the privacy of all respondents.

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