Usability Analysis of The Student Service Information System at The Faculty of Engineering Tadulako University Using Heuristic Evolution and The System Usability Scale (SUS)

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Abstract

The Student Service Information System is defined as a system designed to assist students, faculty, and administration at Tadulako University's Faculty of Engineering in managing various academic aspects. This research identifies issues or obstacles users face while utilizing the website. The usability evaluation employs the Heuristic Evaluation method and the System Usability Scale (SUS). Based on the research conducted with 100 respondents, all active students at Tadulako University, the usability measurements revealed significant findings. According to the Heuristic Evaluation method, which utilizes 10 principles, areas requiring improvement were identified in qualifications B1.2, B3.3, B8.2, B10.2, and B10.3. Recommendations for enhancements include adding a notification feature, ensuring the search function is easily discoverable, selecting appropriate color combinations, and improving the placement of the user guide. The System Usability Scale yielded a score of 50, categorizing the website as "OK" on the adjective scale, "D" on the grade scale, and "Marginal" on the acceptability scale, with a net promoter score indicating a "Passive" reception.

Keywords *— Heuristic Evolution, Usability, System Usability Scale, Student Service Information System*

1. INTRODUCTION

Tadulako University is one of the higher education institutions that uses information technology to communicate, discuss, and share ideas and information. It is evident from the teaching and learning process, that Tadulako University has utilized various computer information technologies to improve the quality of education. One of them is the *website* The Student Service Information System of the Faculty of Engineering, Tadulako University has many benefits, including that students can access important information such as lecture schedules, announcements, and grade results online. In addition, this website also facilitates the administrative process, and communication with guardian lecturers, and provides a variety of useful guides [1]. Overall, the objectives of *the website* is to be used in providing better services and easier access to information for the entire academic community of the Faculty of Engineering, Tadulako University. A *website* Of course, there are problems *with usability* that can annoy its users [2]. One of them is the Service Information System of

the Faculty of Engineering, Tadulako University where it is necessary to hold an evaluation to be able to increase user satisfaction. In this case, it is necessary to hold an evaluation to be able to improve the user experience when opening this *website*. In addition, the Student Service Information System has never been evaluated to find out its problems and weaknesses systematically using this method.

According to ISO 9241-11 Document *usability* (usability) is defined as the degree to which software or systems can operate in a certain way to achieve a goal by maximizing efficiency, effectiveness, and user satisfaction. The website is evaluated not only based on its attractive design but also on the fact that users find it convenient and easy to use [3]. Therefore, it is necessary to conduct a usability analysis *usability* to be able to measure user satisfaction. There are many measurement methods *for usability*, so choose the most suitable approach to solving the problem of *usability*. Method *Heuristic Evolution* and *system usability scale* are the two methods applied in this study. *Heuristic Evolution is* used to find errors in the design of the user interface. Thus, the method was chosen because of the indicators that can facilitate the analysis[2]. While *system usability scale* is a relatively simple way to test how people perceive the usefulness of a system. By combining these two methods, it is hoped that a review can be obtained from two perspectives: users and experts.[4].

In a previous study conducted by Andi Nur Rachman 2022 on Usability Evaluation, SIMAK used *Heuristic Evaluation* resulting in a score of 70.74%, while WEBUSE gave a score of 67.84%. Both methods are consistent, suggesting that *usability* SIMAK is at the "Good" level. However, some indicators still show low values, indicating the need for further improvement based on existing recommendations to improve the quality of the system [3]. Furthermore, research conducted by Sabri Balafif 2022 on evaluating the quality of websites using *Heuristic evolution* with *Saverity Ratings* and *System Usability Scale* (SUS) By *Severity Ratings*, found that the color blend and clarity of the layout needed to be improved, This indicates a problem in the *user-friendly* that does not interfere with the main function but should be optimized. Overall, the website works well, although there is room for improvement [4].

The purpose of this study is to evaluate the usability of the Student Service Information System with the *heuristic evolution* and *system usability scale*, to identify usability issues *website*, and propose improvements *website* Based on the results of the evaluation [5].

2. RESEARCH METHOD

2.1. Data Analysis Methods

This method has several stages that are carried out, starting from problem identification, literature study, data collection, usability testing, then data analysis and data processing using 2 methods, preparation of results and recommendations, and ending with completion. In Figure 1, the following shows the research process carried out by the researcher.

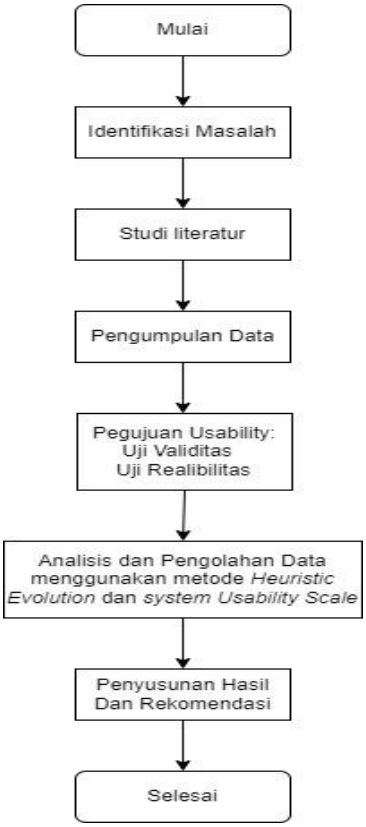

Figure 1. Research process

2.2. Problem Identification

Problem identification is the first step in mastering a problem, allowing us to consider a given object in a certain [6]. In this stage, problem identification is carried out by direct observation to find out the responses of system users.

2.3. Literature Studies

At this stage, it is used to review and search for journals related to this research. The data from this study will serve as a guide for further research at the level of literature review[7].

2.4. Data Collection

In the process of data collection, several processes are carried out according to the method used, namely[2]. For data collection using techniques *of Heuristic Evolution* that require respondent data with 100 people using *Google Form* [6][8]. The number of respondents is determined using the formula *Cochran* with *a margin error* of 10% and 95% confidence level. The formula is used to calculate the sample size required for the survey. Furthermore, the assessment uses *Microsoft Excel*, the results will be averaged, and classified by severity to be corrected before use.

The *System Usability Scale* is a scale used in assessing respondents to evaluate users.[9]. The questionnaire in this study has 10 aspects of statements using a Likert scale (both positive and negative) starting from (values on a scale of 1-5) [10]. Thus, it can be concluded that Table 1 shows the list of SUS questions as follows:

Table 1. SUS Question Questionnaire

It	SUS Questions
1.	I'm thinking of using this system again.
2.	I feel that this system is too complicated to use
3.	I feel that this system is very easy to use
4.	I thought that I would need technical support in using this system.
5.	I feel that this system is working as it should
6.	I feel that there is a mismatch or incompatibility with this system.
7.	I feel like others will understand by using this system.
8.	I find that this system is confusing for users (not easy to use)
9.	I feel that there is no difficulty in using this system.
10.	I need a lot of things to learn before I can use this system properly.

2.5. Usability Testing

a. Validity Test

Before the system validity test tool is used, the researcher must ensure that each questionnaire question to be asked is valid or not using software *Microsoft Excel* [11]. By conducting a validity test, the correlation formula is used *Pearson* with a significance level of 5% (0.195) which will later be used to test the validity of this research. The result is considered valid if the table is greater than the calculation. There is a correlation formula that can be seen in the following equation 1

$$r_{xy} = \frac{n(\sum XiYi) - (\sum Xi)(\sum Yi)}{(n\sqrt{\sum Xi2) - (\sum Xi)2)}\ (n(\sum Yi2) - \sum Yi))} \quad (1)$$

Information:

n = Number of data groups X and Y
$\sum Xi$ = Sum of the X variable
$\sum Yi$ = Sum of the Y variable
$\sum Xi^2$ = The square is derived from the whole sum X
$\sum Yi^2$ = Square derived from the whole sum of Y
$\sum XiYi$ = Total multiplication of variables X and Y

b. Reality Test

Reality tests are carried out to be able to ensure the level of realism of the instrument in the evaluation results *in usability* by using the formula *Cronbach alpha* [2],[12]. In this equation shows the formula *Cronbach alpha* to calculate the value of realism. It can be seen in the following equation 2

$$r_{11} = \left(\frac{n}{n-1}\right)\left(1 - \frac{\sum \sigma t^2}{\sigma t^2}\right) \quad (2)$$

Information:

r_{11} = Value *Crobanch alpa*
n = Lots of questions tested
$\sum \sigma t^2$ = number of question variants
σt^2 = Varians total

2.6. Data Analysis and Processing Using Heuristic Evolution and System Usability Scale Methods

In this study, the method *Heuristic Evolution* and *System Usability Scale* were used to analyze *the usability* Student Services Information System. For the *Heuristic Evolution,* the percentage of respondents' answers will be classified (from strongly disagreeing to strongly agreeing). Next for the *System Usability Scale,* The percentage of each item will be calculated to show how good or bad each item is variable [13]. The percentage of calculations on the questionnaire to measure *usability* can be seen in the following table.

Table 2. Percentage of Questionnaire calculation

Category	Value
A	85-100
B	65-84
C	55-64
D	0-54

In addition, the SUS method requires calculation using the Likert scale obtained after filling in the respondents [2]. The SUS questionnaire data itself will be calculated based on equations 3, 4, and 5. The SUS score value can be calculated by normalizing each respondent's answer on a scale of 0-4 [14].

Each odd-numbered question score will be deducted by one. The calculation can be seen in the following equation 3

$$\text{Odd score} = (xi - 1) \quad (3)$$

For each question with an even score, it will be deducted 5 for each question. The calculation can be seen in Equation 4

$$\text{Even score} = 5 - xi \quad (4)$$

Next, the odd and even scores will be added up then the SUS score will be obtained by multiplying it by 2.5. This calculation can be found in Equation 5

$$\text{Overall score} = (\text{Odd value} + \text{Even value}) * 2.5 \quad (5)$$

Once the SUS score is validated, the next step is to interpret the score *System Usability Scale*. *Range acceptability, grade scales, and adjective ratings* are some of the interpretation methods that can be used in this SUS method.[15]. The SUS approach can be categorized into several levels such as: *Not Acceptable, Marginal,* and *Acceptable*. For the SUS approach in Table 3 below.

Table 3. SUS Approach

Value	Category
0-100	*Acceptable*
50-70	*Marginal*
70-100	*Not Acceptable*

Furthermore, the SUS category is shown in the following table with the highest scale A and the lowest scale F. The System Usability *Scale* category can be seen in the following table

Table 4. Category: SUS

Category	Value
Excellent	85-100
Good	70-84
Enough	50-69
Bad	40-49
Very Bad	*Below* 40

After the SUS score assessment is complete, it can be known where the usefulness of *the website* is. This can be seen in the table below

Table 5. SUS Category Assessment

Value	Category
85 -100	*Excellent*
70 - 84	*Good*
50 - 69	OK
Below 50	Poor

2.7. Preparation of Results and Recommendations

In the final stage, by applying the *Heuristic evolution* and *System Usability Scale* The data that has been processed will be summarized so that a final conclusion is obtained regarding the evaluation of the usability *website* Student Services Information System, after which recommendations are given to correct the problems found [3], [16].

3. RESEARCH RESULTS AND DISCUSSION

3.1. Testing Usability Heuristic Evolution

3.1.1. Validity Test

The validity test will be carried out using data from 100 respondents [17]. To perform a validity test, five steps must be followed: enter the data, calculate the number of scores, search for the count, search for the table, and determine the validity status. By entering the formula SUM=(Row 1- Row 100) to find out the total score of each respondent. To find the calculation value use =CORREL then select fx (respondent1 column - respondent 100 columns). Furthermore, the value of distraction or signification is 5% or 0.195. In addition, to determine validity use IF (column of table>, "Valid", "Invalid"). The following table 6 shows the results of the tests.

Table 6. Validity Test Results *Heuristic Evolution*

No. Item	Indicator	Coefficient value	Distribution Value	Validity Results
B1.1	*Visibility of status*	0,617	0,195	Relief
B1.2		0,332	0,195	Relief
B1.3		0,584	0,195	Relief
B2.1	*Match between the system and the real world*	0,539	0,195	Relief
B2.2		0,502	0,195	Relief
B2.3		0,501	0,195	Relief
B2.4		0,512	0,195	Relief
B3.1	*User control and freedom*	0,625	0,195	Relief
B3.2		0,530	0,195	Relief
B3.3		0,437	0,195	Relief
B4.1	*Consistency and standards*	0,546	0,195	Relief

No. Item	Indicator	Coefficient value	Distribution Value	Validity Results
B4.2		0,511	0,195	Relief
B4.3		0,512	0,195	Relief
B5.1	*Error prevention*	0,534	0,195	Relief
B5.2		0,639	0,195	Relief
B6.1	*Recognition rather than recall*	0,648	0,195	Relief
B6.2		0,567	0,195	Relief
B6.3		0,567	0,195	Relief
B7.1	*Flexibility and efficiency of us*	0,712	0,195	Relief
B7.2		0,554	0,195	Relief
B7.3		0,648	0,195	Relief
B8.1	*Aesthetic and minimalist design*	0,590	0,195	Relief
B8.2		0,379	0,195	Relief
B8.3		0,568	0,195	Relief
B8.4		0,651	0,195	Relief
B9.1	*Help users recognize, dialogue, and recover from errors*	0,690	0,195	Relief
B9.2		0,520	0,195	Relief
B9.3		0,633	0,195	Relief
B10.1	*Help and document*	0,609	0,195	Relief
B10.2		0,271	0,195	Relief
B.10.3		0,272	0,195	Relief

The results of the validity test of all indicators in the *Heuristic Evolution* method prove that all of these instruments can be declared Relevant.

3.1.2. Reality Test

Reality tests determine the consistency of a measuring instrument, or the ability to make repeated measurements. The tools used to measure research data are considered realistic.[18]. There are seven steps to conducting a reality test. First, you have to enter data, then you have to calculate the number of scores, then calculate the total variation, item variation, value *Cronbach alp*ha, and finally determine the status of reality. The way to calculate item variants is to use the VAR function (from the respondent column 1 to the respondent column 100), use the SUM function (from the celebration item variants 1 to 31), and use the VAR function (Total score of each respondent). Value *Cronbach alpha* (R11) is derived from equation formula 2. Furthermore, to be able to calculate the total variance with the IF Formula (Realible or Not Realible). To see the test results, you can see the following table.

Table 7. Reality Test

Number of Variants	25,549
Varians Total	226,328
R11	0,916
Realism	Realizable

In the table, the *Cronbach alpha* value of 0.916 The results above show that the value has exceeded the significance value of 0.60, it can be concluded that the tool used is Reliable.

3.1.3. Calculation Results for Good and Good Enough Variables

The table below shows the results of the calculation based on the statement that each variable is included in the category of good and quite good.

Table 8. The Results of The Variable Calculation are Good and Quite Good

No. Item	Indicator	Coefficient value	Information
B1.1	*Visibility of status*	0,617	Pretty Good
B1.3		0,584	Pretty Good
B2.1	*Match between the sistem and the real world*	0,539	Pretty Good
B2.2		0,502	Pretty Good
B2.3		0,501	Pretty Good
B2.4		0,512	Pretty Good
B3.1	*User control and freedom*	0,625	Pretty Good
B3.2		0,530	Pretty Good
B4.1	*Consistency and standards*	0,546	Pretty Good
B4.2		0,511	Pretty Good
B4.3		0,512	Pretty Good
B5.1	*Error prevention*	0,534	Pretty Good
B5.2		0,639	Pretty Good
B6.1	*Recognition rather than recall*	0,648	Pretty Good
B6.2		0,567	
B6.3		0,567	Pretty Good
B7.1	*Flexibility and efficient use*	0,712	Good
B7.2		0,554	Pretty Good
B7.3		0,648	Pretty Good
B8.1	*Aesthetic and minimalist design*	0,590	Pretty Good
B8.3		0,568	Pretty Good
B8.4		0,651	Good
B9.1	*Help users recognize, dialogue, and recover from errors*	0,690	Good
B9.2		0,520	Pretty Good
B9.3		0,633	Pretty Good
B10.1	*Help and document*	0,609	Pretty Good

For the results of the calculation in Table 8, it can be decided that it has obtained good points to be maintained.

3.1.4. Poor Variable Calculation Results

Based on each variable in the category having a bad statement, the results of the calculation can be seen in the following table.

Table 9. The Results of The Variable Calculation are Not Good

No. Item	Indicator	Coefficient Value	Information
B1.2	*Visibility of status*	0,332	Not Good
B3.3	*User control and freedom*	0,437	Not Good
B8.2	*Aesthetic and minimalist design*	0,379	Not Good

No. Item	Indicator	Coefficient Value	Information
B10.2	*Help and document*	0,271	Not Good
B10.3		0,272	Not Good

From the results in Table 9, it can be concluded that several variables have not been said to be good. Therefore, there are indicators that must be improved so that *the website* can become better.

3.1.5. Repair Recommendations

This recommendation is obtained based on categories with poor variables. So it can be seen in the following table 10

Table 10. SINAWA Improvement Recommendations

No. Item	Indicator	Recommendations
B1.2	*Visibility of status*	Added a notification feature to let users get instant notifications. Even though they are not opening a website.
B3.3	*User control and freedom*	Ensure that the search feature is easy to find and use by users. Place the feature next to the top right and use clear icons and labels so that users can understand it
B8.2	*Aesthetic and minimalist design*	Choose an interesting color combination to provide enough contrast so that users don't get bored quickly to visiting the website.
B10.2	*Help and document*	The assistance menu needs to be improved. It should be consistent with its functionality to help users when an error occurs and should be available to facilitate the search for information.
B.10.3		The manual menu needs to be improved. The guidebook should be right below the login page which can make it easier for users to find the information they need

Table 10 illustrates suggestions for improvement that can be obtained from the evaluation of the usefulness of the research. This suggestion is expected to be applied when developing the *Student Service Information System website so that it can be used even better in the future.*

3.2. Hasil Usability System Usability Scale

From the survey results, the results of the SUS questionnaire in the following Table 11 can be presented.

Table 11. SUS Questionnaire Results Data

Rs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
R1	3	3	4	3	4	4	4	3	3	3
R2	5	3	3	4	4	5	5	3	3	5
R3	3	4	2	4	2	4	3	3	3	4
R4	3	2	4	2	4	2	3	1	3	3
R5	4	3	4	3	3	3	3	3	3	4

Rs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
R6	4	4	4	4	4	4	4	4	4	4
R7	3	2	4	2	5	4	4	4	4	4
R8	3	2	2	4	3	5	5	3	5	5
R9	3	3	2	3	2	4	3	4	4	3
R10	3	4	3	2	3	3	3	2	2	4
…	…	…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…	…	…
R96	4	3	4	3	4	3	3	5	5	5
R97	4	2	4	2	3	3	2	3	2	4
R98	4	5	5	4	4	4	4	3	4	5
R99	2	2	4	3	4	5	5	4	5	5
R100	4	3	2	3	4	3	3	3	3	4

From the SUS questionnaire data, it can be normalized by using equations 3, 4, and 5 to obtain SUS score results. The total SUS score is calculated by finding the average value of the overall SUS score. The total SUS score and SUS score and SUS score can be seen in table 12.

Table 12. SUS Questionnaire Results

Rs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
R1	2	2	1	2	1	1	1	2	2	2
R2	4	2	2	1	1	4	4	2	2	4
R3	2	1	3	1	3	1	2	2	2	1
R4	2	3	1	3	1	3	2	0	2	2
R5	1	2	1	2	2	2	2	2	2	1
R6	1	1	1	1	1	1	1	1	1	1
R7	2	3	1	3	4	1	1	1	1	1
R8	2	3	3	1	2	4	1	2	4	4
R9	2	2	3	2	3	1	2	1	1	2
R10	2	1	2	3	2	2	2	3	3	1
…	…	…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…	…	…
R96	1	2	1	2	1	2	1	4	4	4
R97	1	3	1	3	2	2	3	2	3	1
R98	1	4	4	1	1	1	1	2	1	4
R99	3	3	1	2	1	4	4	1	4	4
R100	1	2	3	2	1	2	2	2	2	1

Table 13. SUS Average Score

Rs	Total Score	Score SUS
R1	16	40
R2	26	65
R3	18	45
R4	19	48
R5	17	43
R6	10	25
R7	18	45
R8	26	65
R9	19	48
R10	21	53

Rs	Total Score	Score SUS
…	…	…
…	…	…
R96	22	55
R97	21	53
R98	20	50
R99	27	68
R100	18	45
Average SUS score		**50**

Table 14. Score SUS

Scale	Adjective Rating
Score SUS	50
Grade	C
adjective	OK
Acceptable	*MARGINAL*
NPS	*Passive*

With the final score obtained after the calculation in Tables 13 and 14, it was obtained that the usability level of the Student Service Information System website had a D value with the average score obtained by SUS being 50. Furthermore, the SUS score will be compared based on *the curved grading scale* (CGS). Based on the results of the comparison of *the adjective scale* in the "OK" category, the grade scale of the "D" category and *the acceptability scale* are in the "*Marginal*" category with *the net promoter scores* of the "*Passive*" category.

4. CONCLUSION

From the explanation above, a decision can be made according to the results of the measurement of *the usability* level carried out on the *Student Service Information System website with the use of* the Heuristic Evolution *method and* the System Usability Scale *found that the usability level* is at the "Good" level. That way, many indicators at low scores show that *the* SINAWA website is still not perfect as a whole, the problems obtained are in terms of *User control and freedom* B3.3 (Users can easily search for the data they want using the search feature), *Aesthetic and minimalist design* B8.2 (Less attractive colors), *Help and document* B10.2 (No help menu) B10.3 (The system does not have a manual right on the login page). The SINAWA website should be improved again to improve the usability for all users. For *the system usability scale method*, the SUS score was obtained which was 50 based on the results of the comparison of the *adjective scale* level in the "OK" category, the grade scale category "D" and *the acceptability scale* in the "*Marginal*" category with *the net promoter scores* category "*Passive*". Therefore, the Student Service Information System website has not been able to meet the required criteria.

5. SUGGESTED

Based on the results of this study, it is used as a recommendation to be able to change the website to make it easier to use. For the next researcher, the usability evaluation is carried out using other techniques to get better results. The results of this study also show that the Student Service Information System has better features such as every text on the system can be read well, the menu layout is easily accessible to users and the information in the system is clear and not confusing. However, some parts still need further improvement.

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