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Usability Evaluation of SIMAK at Udayana University Using Outlier Identification with Webuse and Heuristic Methods

Deppy Librata[1*], Putu Desiana Wulaning Ayu[2], Roy Rudolf Huizen[3]

[1,2,3] Magister program, Department of Magister Information systems, Institut Teknologi dan Bisnis STIKOM Bali, Indonesia

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***Correspondence Address:**
232011021@stikom-bali.ac.id

ABSTRACT

Universities require reliable and user-friendly academic information systems to support teaching, learning, and administrative processes. However, the usability of such systems often encounters obstacles that affect user satisfaction and operational efficiency. This study evaluates the usability of the Sistem Informasi Manajemen Akademik (SIMAK) at Udayana University using a combined Webuse questionnaire and Heuristic Evaluation approach. A total of 100 student responses were collected, and outlier identification using standard deviation analysis removed 34 inconsistent responses. This step was essential for preventing inflated Webuse scores and ensuring that the final dataset (n = 66) more accurately reflected typical user experiences.The Webuse results classify all usability dimensions in the “Excellent” category Content Organization & Readability (0.86), Navigation & Links (0.83), User Interface Design (0.84), and Performance & Effectiveness (0.81). However, the heuristic evaluation conducted by four expert evaluators identified 19 moderate to high-severity issues, revealing critical weaknesses in system responsiveness, interface consistency, and error prevention. These contrasting outcomes highlight that high perceived satisfaction does not necessarily align with expert-validated usability standards.
The main contribution of this study lies in integrating outlier detection to refine questionnaire-based usability data, resulting in more valid interpretations. The findings offer practical recommendations for improving SIMAK’s performance, interface clarity, and error-handling mechanisms, while providing methodological insights for future usability evaluations.

Keywords : *Usability; Evaluation; SIMAK; Webuse; Heuristic Evaluation.*

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1. INTRODUCTION

Educational institutions play a vital role in transferring knowledge and culture, helping individuals prepare for future challenges [1]. As formal institutions, universities must ensure the availability of efficient academic information systems that support teaching, learning, and web-based academic administration. Such systems typically integrate academic data management with platforms that facilitate interactions between lecturers, students, and other stakeholders [2]. Udayana University, as the oldest public university in Bali, continues to pursue its vision through improvements in infrastructure, service quality, curriculum, and academic information systems.

One of its key systems is the Sistem Informasi Manajemen Akademik (SIMAK), launched in 2012 and integrated into the IMISSU ecosystem in 2015. Although designed to streamline academic processes, SIMAK still presents usability challenges, particularly for students who struggle to operate the system comfortably and efficiently. This supports the argument of [3] that usability evaluation is necessary to determine how well an academic information system meets user needs.

Various usability evaluation methods are available. The System Usability Scale (SUS) measures effectiveness, efficiency, and user satisfaction [4], while the User Experience Questionnaire (UEQ) captures user experience through standardized dimensions [5]. The Cognitive Walkthrough evaluates how users perform tasks based on specific scenarios [6]. Webqual 4.0 assesses usability quality, information quality, service interaction quality, and overall impression [7], whereas WEBUSE measures usability through 24 user-focused questions [8]. Heuristic Evaluation, on the other hand, involves expert reviewers assessing a system based on usability heuristics [9], [12], and prior studies confirm WEBUSE as a reliable usability measurement tool [10], [11].

Previous research has identified usability limitations across multiple platforms. Issues in navigation and interface consistency were found on Prokal.co [13], whereas the ATRBPN system struggled with ease-of-use and feedback mechanisms [14]. A faculty website exhibited weaknesses in information structure and user interaction [15], and the Disdukcapil website required improvements in accessibility and loading speed [16]. However, most of these studies did not consider data quality in questionnaire-based methods. Outlier responses can distort Webuse results, reduce validity, and lead to inaccurate interpretations. In addition, many studies relied on a single evaluation method, limiting the comprehensiveness of their assessments.

To address these gaps, the present study integrates outlier identification into the Webuse process to ensure higher data reliability by removing inconsistent or extreme responses. The study also compares Webuse with Webqual 4.0, a method widely validated in previous research, to test the consistency of user-based usability measurements. Furthermore, Heuristic Evaluation is included to provide expert-based insights into interface consistency, error prevention, and performance.

In summary, this study establishes a methodological connection between Webuse, Webqual, and Heuristic Evaluation by combining user-based and expert-based approaches, comparing measurement consistency, and strengthening validity through outlier identification. This integrated approach provides a more accurate and comprehensive evaluation of SIMAK and offers valuable methodological contributions for future usability research.

2. METHODS

This research adopts a combined approach using two key methods Webuse and Heuristic Evaluation to assess usability. The integration of these methods aims to provide a well-rounded perspective on how users interact with the system being evaluated. The following flowchart outlines the stages of the usability assessment process, beginning with the literature review and ending with the formulation of conclusions and recommendations.

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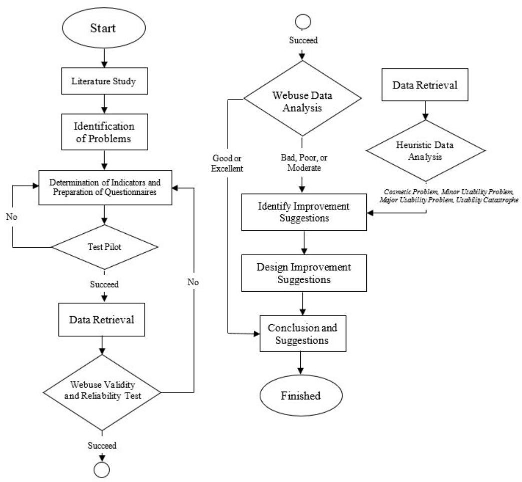

Figure 1. *Research Workflow*

2.1. Data Collection

The population in this study consists of all active students enrolled in the Medical Postgraduate Program, totaling 320 students. According to [17], identifying usability problems with more than five users tends to result in repeated findings of the same issues. However, [18] argues that usability testing with only five participants typically uncovers about 55% of usability problems, while [19] suggests that a minimum of 15 users is needed to detect 90% of the issues. Based on the total population of 320 students, the sample size was determined using the Slovin's equations (1) [20] :

$$n = \frac{320}{1 + 32(0.1)^2}$$
$$= \frac{320}{1 + 3.21}$$
$$= 76 \text{ (rounded up to 100)} \quad (1)$$

From the calculation above, the sample size was determined to be 100 respondents who completed the questionnaire

2.2. Questionnaire Design

The questionnaire was designed based on indicators relevant to the research variables, as outlined in the conceptual framework. Each item was crafted using simple, clear language to ensure ease of understanding by respondents and to minimize the potential for interpretation bias. Below is the list of questionnaire statements for the Webuse, Webqual 4.0 and Heuristic dimensions, based on the indicators from the operational definitions of the variables [11] [9] as shown in Table 1, Table 2, and Table 3.

Table 1. *Questionnaire of Webuse*

Variable	Indicator	Statement
Content, Organization, & Readability	W1.1	The content on SIMAK is relevant to my needs.
	W1.2	I can easily find the information I am looking for on SIMAK.
	W1.3	The information on SIMAK is well-organized and easy to understand.
	W1.4	The text on SIMAK is easy to read.
	W1.5	The language used on SIMAK is easy to understand.
	W1.6	The content layout on SIMAK is not too wide, so I don't need to scroll sideways.
Navigation & Links	W2.1	I always know where I am when using SIMAK.
	W2.2	SIMAK provides clear navigation instructions.
	W2.3	I can easily move between pages on SIMAK.
	W2.4	The links on SIMAK work properly.
	W2.5	SIMAK does not open unnecessary new windows.
	W2.6	The placement of links and menus on SIMAK is consistent.
User Interface Design	W3.1	The SIMAK interface design is attractive.
	W3.2	The colors used on SIMAK are comfortable to look at.
	W3.3	SIMAK is free from visual distractions like blinking text or repetitive animations.
	W3.4	The appearance of SIMAK is consistent from page to page.
	W3.5	SIMAK does not display too many advertisements.
	W3.6	The design of SIMAK is intuitive and easy to learn.
Performance & Effectiveness	W4.1	SIMAK has a fast response time.
	W4.2	SIMAK provides clear indicators when processing data.
	W4.3	SIMAK is always accessible.
	W4.4	SIMAK responds quickly to user actions.
	W4.5	SIMAK is efficient to use.
	W4.6	SIMAK provides clear help messages when needed.

Table 2. *Questionnaire of Webqual 4.0*

Variable	Indicator	Statements
Usability	WQ1.1	Easy to operate.
	WQ1.2	Interaction with the website is clear and understandable.
	WQ1.3	Easy to navigate.
	WQ1.4	Attractive appearance.
	WQ1.5	Appearance matches the type of website.
	WQ1.6	Provides additional knowledge from the website information.
	WQ1.7	Layout arrangement is appropriate.
	WQ1.8	Easy to find the website address.
Information Quality	WQ2.1	Provides trustworthy information.
	WQ2.2	Provides up-to-date information.
	WQ2.3	Provides information that is easy to read and understand.
	WQ2.4	Provides sufficiently detailed information.

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	WQ2.5	Provides relevant information.
	WQ2.6	Provides accurate information.
	WQ2.7	Presents information in an appropriate format.
Service Interaction Quality	WQ3.1	Has a good reputation.
	WQ3.2	Provides security for completing transactions.
	WQ3.3	Feel secure in submitting personal data.
	WQ3.4	Has a community atmosphere.
	WQ3.5	Easy to attract interest and attention.
	WQ3.6	Easy to communicate.
	WQ3.7	High level of trust in the delivery of goods/services.
Overall Impression	WQ.4.1	The overall website appearance is good.

Table 3. *Questionnaire of Heuristic Evaluation*

Variable	Indicator	Statement
Visibility of System Status	H1.1	SIMAK always provides clear and complete information.
	H1.2	SIMAK responds quickly to every action I perform.
	H1.3	SIMAK gives confirmation when I successfully complete an action.
Match Between System and Real World	H2.1	The language used on SIMAK is easy to understand.
	H2.2	The symbols and terms used on SIMAK are easy to comprehend.
User Control and Freedom	H3.1	SIMAK responds quickly to every request I make.
	H3.2	I can easily access the information I need on SIMAK.
Consistency and Standards	H4.1	SIMAK's appearance is consistent from page to page.
	H4.2	Menu names and titles on SIMAK are clear and not confusing.
Error Prevention	H5	SIMAK provides notifications if errors occur when filling out forms.
Recognition Rather Than Recall	H6.1	SIMAK's layout is easy to remember.
	H6.2	I can easily recognize the function of each feature on SIMAK.
Flexibility and Efficiency of Use	H7.1	SIMAK is always accessible.
	H7.2	SIMAK can be accessed well from various devices.
	H7.3	SIMAK is easy to access even with a slow internet connection.
Aesthetic and Minimalist Design	H8.1	The font used on SIMAK is easy to read.
	H8.2	The icons and symbols used on SIMAK are easy to understand.
	H8.3	SIMAK's layout is not confusing.
Help Users Recognize, Diagnose, and Recover from Errors	H9.1	SIMAK provides clear solutions when errors occur.
	H9.2	SIMAK provides notifications during maintenance periods.
Help and Documentation	H10.1	SIMAK provides easily reachable help contacts.
	H10.2	I can easily give feedback and suggestions about SIMAK.
	H10.3	SIMAK provides an easy-to-understand user guide.

2.3. Data Collecting

The questionnaire was distributed using Google Forms. Before data analysis using the Webuse method, the questionnaire results underwent validity and reliability tests, followed by outlier identification.

2.3.1. Validity and Reliability Test

Validity testing was conducted through construct validity testing. To assess construct validity, the correlation between the instrument under test and another instrument with established validity can be calculated [21]. The validity test is performed using the following equations (2)

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{\{N\sum X^2 - (\sum X)^2\}\{N\sum Y^2 - (\sum Y)^2\}}} \quad (2)$$

r_{xy} = Validity coefficient

N = Number of subjects

X = Comparison score

Y = Score from the instrument being tested for validity

Table 4. *Validity Results for the Content, Organization, & Readability Dimension*

Code	r-count	r-table	Result
W1.1	0.620	0.1946	Valid
W1.2	0.586	0.1946	Valid
W1.3	0.661	0.1946	Valid
W1.4	0.625	0.1946	Valid
W1.5	0.641	0.1946	Valid
W1.6	0.697	0.1946	Valid

Table 5. *Validity Results for the Navigation & Links Dimension*

Code	r-count	r-table	Result
W2.1	0.696	0.1946	Valid
W2.2	0.647	0.1946	Valid
W2.3	0.764	0.1946	Valid
W2.4	0.801	0.1946	Valid
W2.5	0.741	0.1946	Valid
W2.6	0.804	0.1946	Valid

Table 6. *Validity Results for the User Interface Design Dimension*

Code	r-count	r-table	Result
W3.1	0.618	0.1946	Valid
W3.2	0.597	0.1946	Valid
W3.3	0.487	0.1946	Valid
W3.4	0.637	0.1946	Valid
W3.5	0.637	0.1946	Valid
W3.6	0.811	0.1946	Valid

Table 7. *Validity Results for the Performance & Effectiveness Dimension*

Code	r-count	r-table	Result
W4.1	0.761	0.1946	Valid
W4.2	0.742	0.1946	Valid
W4.3	0.701	0.1946	Valid
W4.4	0.828	0.1946	Valid
W4.5	0.852	0.1946	Valid
W4.6	0.851	0.1946	Valid

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Tables 4, 5, 6, and 7 show the results that all items have a calculated correlation coefficient (r-count) above the critical value (r-table) of 0.1946.

Reliability refers to the consistency of a set of measurements or measurement instruments [22]. Reliability is different from validity, as a valid instrument does not necessarily produce consistent results, and vice versa. An instrument, in this case a questionnaire, is considered reliable if the reliability coefficient approaches 1, with a common agreement that a value of 0.700 or higher is acceptable [23].

As the research instrument consists of a questionnaire with a Likert-type scale. The reliability test of the instrument was conducted using Cronbach's Alpha equations (3).

$$\text{Rac} = \left(\frac{k}{k-1}\right)\left[1 - \frac{\sum\sigma_b^2}{\sigma_t^2}\right] \quad (3)$$

Notes :
rac = Cronbach's Alpha reliability coefficient,
k = number of items/questions
$\sum\sigma_b^2$ = sum of the variances of each item/question,
σ_t^2 = total variance

Table 8. *Result of Cronbach's Alpha Reliability*

Dimension	Cronbach's Alpha	Result
Content, Organization, & Readability	0.836	Reliable
Navigation & Links	0.887	Reliable
User Interface Design	0.835	Reliable
Performance & Effectiveness	0.938	Reliable

All dimensions in table 8 are part of the measurement instrument showed Cronbach's Alpha values above 0.60, indicating that the instrument has good reliability and is suitable for consistent measurement.

2.3.2. Outlier Test

Outliers can be defined as observations that significantly differ from or are distant from other observations [24]. One of the simplest and most effective methods for detecting outliers is by using measures of data dispersion, namely standard deviation. This method is particularly useful for identifying respondent answers that are monotonous or overly consistent.

Standard deviation are two statistical measures used to determine the spread or variability of data from the mean. Variance measures the average squared deviation of each data point from the mean. In this study, the variance equations is cited from the research by [25]. The results of standard deviation values for the Webuse Questionnaire are presented in Table 9.

In questionnaire-based usability testing, extremely homogeneous responses (e.g., identical answers across all items) often reflect careless responses, satisficing behavior, or non-differentiated thinking, which may distort latent constructs and inflate usability scores. According to Sihombing et al. [24], outliers in Likert-type data can be identified using dispersion-based criteria such as variance and standard deviation. Respondents with a standard deviation approaching zero are typically considered problematic because they indicate straight-lining behavior rather than meaningful evaluation. Therefore, the use of SD = 0 as an outlier threshold in this study follows recommendations from dispersion-based univariate detection techniques.

Respondents with standard deviation values that are very small (close to zero) indicate that the answers given are nearly identical or monotonous.

Table 9. *Standard Deviation Data of Webuse Questionnaire Results*

No. Respondent	Standard Deviation	No. Respondent	Standard Deviation
1	0	51	0.442326
2	0.337832	52	0.658005
3	0.28233	53	0.76967
4	0.337832	54	0
5	0.464306	55	0
6	0	56	0.448427
7	0.380693	57	0.658005
8	0.414851	58	0
9	0.464306	59	0.337832
10	0.624094	60	0.204124
11	0	61	0
12	0.780189	62	0.337832
13	0.780189	63	0
14	0	64	0.624094
15	0.380693	65	0.204124
16	0.508977	66	0
17	0	67	0.612372
18	0.28233	68	0
19	0	69	0.28233
20	0.380693	70	0
21	0.508977	71	0
22	0	72	0.337832
23	0.481543	73	0.294884
24	0.780189	74	0.50361
25	0.464306	75	0
26	0.337832	76	0
27	0	77	0.508977

28	0.508977	78	0.494535
29	0.589768	79	0
30	1.063219	80	0.28233
31	0.380693	81	0
32	0.28233	82	0.28233
33	0.510754	83	0.50361
34	0.380693	84	0.204124
35	0	85	0.204124
36	0.448427	86	0
37	0	87	0.204124
38	0	88	0
39	0.761387	89	0
40	0.481543	90	0
41	0.50361	91	0.28233
42	0	92	0.28233
43	0.50361	93	0
44	0	94	0
45	0.50361	95	0.793999
46	0.204124	96	0.717282
47	0.637022	97	1.102533
48	0.50361	98	0
49	0	99	0.550033
50	0.337832	100	0.28233

Table 9 shows that out of 100 respondent data, 34 outliers were identified with standard deviation values of 0. standard deviation of 0 indicates that the respondents' answers to each item were highly monotonous or equals [26]. After identifying and removing these outliers based on standard deviation of each respondent's answers, 66 valid responses remained from the original 100 and were used for further analysis

In questionnaire-based usability testing, extremely homogeneous responses (e.g., identical answers across all items) often indicate careless responses, satisficing behavior, or non-differentiated thinking. According to Sihombing et al. [24], outliers in Likert-scale data may be detected using dispersion measures such as variance or standard deviation. Respondents whose standard deviation approaches zero are typically classified as problematic because their responses do not reflect meaningful evaluation. Thus, the use of SD = 0 as a threshold in this study aligns with dispersion-based univariate outlier detection.

To ensure that removing 34 outlier respondents (34%) did not distort the Webuse conclusions, a sensitivity analysis was conducted by comparing the mean scores before and after outlier removal. Before removal (n = 100), average Webuse scores were 0.89, 0.86, 0.87, and 0.84, whereas after removal (n = 66), the values decreased to 0.86, 0.83, 0.84, and 0.81. Although the usability classification remained "Excellent," the consistent reduction of 0.03–0.05 points shows that outliers inflated the usability scores. This confirms that the outlier removal enhanced data validity without altering the fundamental interpretation.

3. RESULTS AND DISCUSSION

3.1. Testing of Webuse and Webqual 4.0 Methods

Prior to undertaking further research to assess the usability of the SIMAK academic information system, the researcher conducted a comparative analysis of the Webuse and Webqual 4.0 usability evaluation methods. This comparison aimed to test the hypothesis that the Webuse method is more effective in measuring usability, particularly within the context of information systems.

The data for this method testing was collected from the same 100 respondents, where each respondent provided assessments for both usability testing methods: Webuse and Webqual 4.0. Understanding the relationship between variables is a crucial initial step before conducting more advanced analyses, especially when aiming to examine the differences between the two measurement approaches.

3.1.1. Correlation Test between Webuse and Webqual 4.0 Methods

The correlation and Wilcoxon analyses were conducted not merely to compare the two methods, but to determine the extent to which Webuse and Webqual 4.0 measure similar or distinct aspects of usability. This step aligns with the study objective of validating whether Webuse alone is sufficiently reliable or whether complementary evaluation with Webqual 4.0 is required. A significant correlation would indicate conceptual alignment, while the Wilcoxon results help determine whether the two instruments produce statistically comparable usability scores.

The correlation test between the Webuse and Webqual 4.0 methods was conducted to determine the extent of the relationship or association between the two variables. According to [27], Spearman's rank correlation is a non-parametric statistical method used to measure the strength and direction of the relationship between two paired variables.
Spearman correlation equations (4):

$$\rho : 1 = \frac{6 \sum_{i=1}^{N} \mathrm{d}i^2}{N3-N} \quad (4)$$

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Notes :
P (Rho) = Spearman's rank correlation coefficient
N = Number of samples
di2 = Squared difference in ranks between variable X and Y

Hypotheses for the Spearman Correlation Test:
Ho : There is no significant relationship between the Webuse and Webqual 4.0 methods.
H1 : There is a significant relationship between the Webuse and Webqual 4.0 methods.

The hypothesis was tested by comparing the significance value (2-tailed) to the alpha level ($\alpha = 0.05$):

If sig. (2-tailed) > 0.05, then H_0 is accepted.
If sig. (2-tailed) < 0.05, then H_1 is accepted.

The results of the Spearman correlation test indicate that all relationships between the Webuse and Webqual 4.0 variables show a significance value of $p = 0.000$. This means the correlation is statistically significant (as the Asymp. Sig. (2-tailed) < $\alpha = 0.05$), and therefore H_1 is accepted.

To better illustrate the strength and direction of the correlations between individual variables, the results are visualized in the following heatmap of the correlation between Webuse and Webqual 4.0 variables in figure 2.

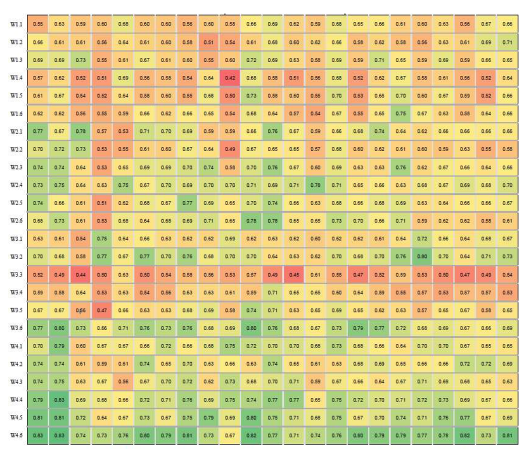

Figure 2 *Correlation Heatmap Between Webuse and Webqual 4.0 Variables*

Based on the correlation coefficients displayed in the heatmap above, it can be observed that the Spearman correlation levels between the Webuse variables (WU1.1 to WU4.6) and Webqual 4.0 variables (WQ1.8 to WQ4.1) exhibit a consistent and positive relationship across both groups. Several pairs of variables in the heatmap show a very strong correlation, with Spearman correlation coefficients exceeding 0.75. Notable examples include the pairs WU4.6 with WQ1.1, WU4.6 with WQ1.2, and WU4.4 with WQ1.2, each demonstrating a high correlation value of 0.83 indicating a very strong association between these variables. However, there are also variable pairs that warrant special attention due to their weaker correlations. For instance, the pair WU1.4 with WQ2.2 displays a correlation coefficient of 0.42. This value falls within the moderate category, suggesting that the relationship between these two variables is not particularly strong and may be influenced by other factors not captured in the current analysis.

3.1.2. Wilcoxon Signed Rank Test

After identifying that the correlation test results between the Webuse and Webqual 4.0 methods indicate a generally high level of correlation, the next step is to conduct a test to measure the significance of the differences between the two variables using the Wilcoxon Signed-Rank Test. According to [28], the basis for decision-making in accepting or rejecting the null hypothesis in the Wilcoxon Signed-Rank: if the probability value (Asymp. Sig.) is less than 0.05, the null hypothesis is rejected; if the value is greater than 0.05, the null hypothesis is accepted. This test aims to determine whether there is a statistically significant difference between the usability scores produced by the two usability testing methods, namely Webuse and Webqual 4.0. The hypotheses for the test are as follows:

- **Null Hypothesis (H_0):** There is no significant difference between the usability scores produced by the Webuse and Webqual 4.0 methods.
- **Alternative Hypothesis (H_1):** There is a significant difference between the usability scores produced by the Webuse and Webqual 4.0 methods.

The results of the Wilcoxon Signed-Rank Test comparing the usability scores from 100 respondents using the Webuse and Webqual 4.0 methods are presented in Table 10.

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Table 10. *Ranks Wilcoxon Signed-Rank Test Methods Webuse dan Webqual 4.0*

Result	N (Total Respondent)	Mean Rank	Sum of Ranks
Negative Ranks	88	48.72	4287.00
Positive Ranks	8	46.13	369.00
Ties	4	-	-
Total	100		

Notes:

- Negative ranks : A total of 88 respondents had lower overall scores for Webqual 4.0 compared to Webuse, indicating that the Webuse method generally received higher usability scores from most respondents.
- Positive ranks : 8 respondents rated Webqual 4.0 higher than Webuse.
- Ties : 4 respondents gave equal scores to both methods.

Based on the analysis using the Wilcoxon Signed-Rank Test, the majority of respondents 88 out of 100 rated the usability of the Webqual 4.0 method lower than that of Webuse. Only 8 respondents gave higher scores to Webqual 4.0, while 4 respondents assigned equal scores to both methods.

The average rank for the negative ranks was 48.72, where as the positive ranks averaged 46.13. This suggests that, overall, the Webuse method tends to receive higher usability evaluations compared to Webqual 4.0. As shown in Table 11, the test produced a Z-value of −7.189 with a two-tailed significance level (p-value) of .000, which is below the significance threshold of α = 0.05. Since the p-value < 0.05, the null hypothesis is rejected. This indicates that there is a statistically significant difference between the usability scores obtained through the Webuse and Webqual 4.0 methods.

Table 11. *Statistic Method Tests of Webuse and Metode Webqual 4.0*

	Total P Value Webqual 4.0 – Total P Value Webuse
Z	-7.189b
Asymp. Sig. (2-tailed)	.000

3.2. Analysis Results of the Webuse Method

After obtaining the usability scores for each category of variables, the next step was to convert these scores to determine the overall usability level. The levels of usability are summarized in Table 12.

Table 12. *Relationship Between Overall Usability Scores and Usability Levels*

X value	0<=x<=0.2	0.2<x<=0.4	0.4<x<=0.6	0.6<x<=0.8	0.8<x<=1.0
Usability Level	Bad	Poor	Moderate	Good	Excellent

Based on the analysis of the four main variables in the Webuse method, using the equations from [11], the usability evaluation scores were obtained as presented in Table 13.

Table 13. *Webuse Evaluation Results*

No.	Webuse Category	Mean of Merit/Point Usability	Level Usability
1	Content, Organization, & Readability	0.86	Excellent
2	Navigation & Links	0.83	Excellent
3	User Interface Design	0.84	Excellent
4	Performance & Effectiveness	**0.81**	*Excellent*

After obtaining the usability scores for each category, the next step was to determine the overall usability level based on the value ranges outlined in Table 13, where a score of 0.8 < x ≤ 1.0 is classified as **Excellent**. From the table above, all four categories achieved average scores above 0.8, with the highest score reaching 0.86 and the lowest 0.81. Therefore, all categories fall within the **Excellent** level.

3.3. Results of the Heuristic Evaluation Method

This evaluation was conducted by four selected evaluators, as listed in Table 14:

Table 14. *Evaluator Profile*

Evaluator	Age	Experience Area	Length of Experience
1	38	SIMAK Operator	13 Years
2	44	SIMAK Operator	10 Years
3	36	SIMAK Operator	6 Years
4	42	SIMAK Operator	18 Years

The heuristic evaluation was conducted by four evaluators selected based on three criteria: (1) a minimum of five years of experience using SIMAK, (2) familiarity with administrative processes related to SIMAK, and (3) a role requiring frequent interaction with student-facing system modules. Prior to evaluation, a 30-minute briefing session was

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held to explain Nielsen's heuristics, evaluation objectives, and severity rating guidelines.

Evaluators were provided with four task scenarios representing core student workflows: accessing and submitting KRS, updating biodata and uploading documents, checking academic transcripts, and processing UKT payment. These tasks ensured consistency in the evaluation process and allowed cross-examining of core functionality. After individual assessment, evaluators discussed overlapping issues to consolidate findings and determine severity priorities.

3.3.1. Identification of Heuristic Analysis Results

A summary of the number of issues found based on each of Nielsen's heuristic principles is presented in Table 15.

Table 15. *Summary of Identified Issues*

No.	Nielsen's Heuristic Principal	Total Issue
1	Visibility of System Status	2
2	Match Between System and Real World	1
3	User Control and Freedom	0
4	Consistency and Standards	0
5	Error Prevention	2
6	Recognition Rather Than Recall	0
7	Flexibility and Efficiency of Use	8
8	Aesthetic and Minimalist Design	2
9	Help Users Recognize, Diagnose, and Recover from Errors	4
10	Help and Documentation	0
Total Issues		19

Table 16. presents the issues identified by the evaluators after duplicate entries were removed.

Table 16. *Issues Identified by the Evaluators*

No	Evaluator Code	Code	Issue	Severity Rating (0-4)	Violated Heuristic Principle
1	Eva2	H.1	Lack of information display regarding semester details during the KRS filling process	1	Visibility of System Status
2	Eva 1	H1.2	When multiple users access the system simultaneously, there is sometimes a slowdown in menu loading and data saving	3	
3	Eva 1	H2.2	In the Final Assignment menu, the final document section lacks clear instructions on data submission via the 'Details' button, and required uploads must be PDF files	3	Match Between System and Real World
4	Eva1	H5	In the Final Assignment menu, under the Guidance History section, data duplication occurs if users proceed without first selecting the 'Back' button and then 'Add'	3	Error Prevention
5	EVA 3	H5	Notifications in the student biodata form are insufficient, causing frequent input errors such as incorrect use of capitalization and symbols	2	
6	Eva 1,	H7.1	During KRS filling, the system occasionally becomes inaccessible due to high concurrent user volume, causing disruption	2	Flexibility and Efficiency of Use
7	Eva 2	H7.1	Payment of UKT experiences delays, especially near deadlines, with slow loading of payment codes in SIMAK	3	
8	Eva3	H7.1	Occasional delays or errors occur during system access	2	
9	Eva 1,	H7.2	The user role selection feature is not accessible via Chrome browser on iOS devices, despite a generally good interface	2	
10	Eva 2	H7.2	Display inconsistencies appear when accessed on different devices	2	

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11	Eva 2	H7.3	System access is difficult when internet connectivity is slow	2	
12	Eva 3	H7.3	Feature display issues arise during slow internet connections	1	
13	Eva 4	H7.3	When busy entering data and SIMAK connection is unstable, a backup connection is necessary to prevent process interruptions	3	
14	Eva2	H8.2	Some icons or symbols in SIMAK menus do not correspond well with submenu titles, requiring users to read instead of relying on representative icons	3	Aesthetic and Minimalist Design
15	Eva4	H8.3	For prospective students, the current layout is somewhat confusing due to unclear menu guidance; a clearer map or layout is needed for better user understanding	3	
16	Eva 1	H9.1	Direct communication with USDI staff (SIMAK developers) is sometimes needed to obtain help	2	Help Users Recognize, Diagnose, and Recover from Errors
17	Eva 2	H9.1	Occasionally, direct confirmation from the service center is required	1	
18	Eva 3	H9.1	Data input notifications are insufficient	2	
19	Eva4	H9.1	When errors occur, reports can only be made through USDI Care, which sometimes has delayed responses; faster, personal reporting remains preferred	3	

Based on the data in Table 16, several issues with high severity ratings were identified by the evaluators. These problems have the potential to cause user discomfort and negatively impact the overall user experience with the system. In general, the evaluators assigned severity ratings ranging from 2 to 4 for each of the identified issues. The frequency distribution of these severity ratings is presented in Figure 3.

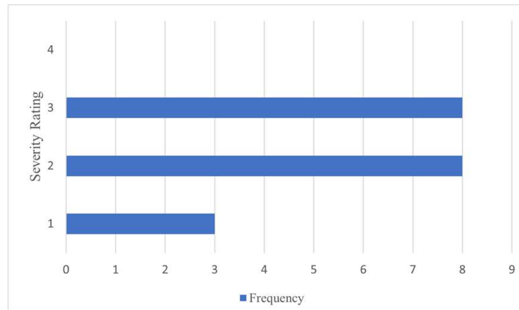

Figure 3. *Frequency Graph of Severity Ratings in SIMAK*

Figure 3 showed there are 8 issues with a high severity rating of 3. These problems have been prioritized for immediate improvement. During the debriefing phase, the four evaluators discussed the top issues based on their severity ratings. For these issues, recommendations for improvements will be formulated, which can later serve as considerations for the SIMAK development team in making future enhancements. It is expected that addressing these suggested improvements will enhance the performance of SIMAK, especially for student users. The final results of the SIMAK usability evaluation using the Heuristic method are presented in Table 17.

Table 17. *Final Results of SIMAK Usability Evaluation Using the Heuristic Method*

No	Issue	Violated Principle	Severity Rating (0-4)	Improvement Suggestions
1	When many users access the system simultaneously, there is sometimes a slowdown in menu loading and data saving.	Visibility of System Status	3	Increase server capacity and optimize system performance to handle high access loads more efficiently. Implementing load balancing can also help maintain system stability

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				during user surges.
2	In the Final Assignment menu, the final document section lacks clear instructions on filling out data via the 'Details' button and the required document format (PDF).	Match Between System and Real World	3	Add clear guidance on how to fill in data using the 'Details' button and specify the required document format, such as PDF files.
3	In the Final Assignment menu, under the Guidance History section, data overlap occurs if users continue input without first selecting the 'Back' button and then clicking 'Add'.	Error Prevention	3	Improve the data input flow by adding validation or prevention mechanisms to avoid data overlap if users do not follow the correct procedure.
4	Issues occur during UKT payment, especially at certain times or near the end of the period, where loading the payment code in SIMAK is delayed.	Flexibility and Efficiency of Use	3	Optimize data loading processes and increase system capacity during peak periods to avoid delays. Consider adding queue systems or wait-time notifications.
5	When users are busy entering data and SIMAK experiences connectivity issues, a backup connection is needed to prevent input interruption.	Flexibility and Efficiency of Use	3	Provide backup connection options or an autosave feature to prevent data loss during connectivity interruptions.
6	Some icons or symbols in the SIMAK menu do not align with the submenu titles, forcing users to read instead of relying on intuitive icons.	Aesthetic and Minimalist Design	3	Adjust icons or symbols to better match menu functions for more intuitive and easily recognizable navigation.
7	For prospective new students, the current layout is somewhat confusing due to insufficient guidance in the display and menus. A clearer map or layout is needed for better understanding.	Aesthetic and Minimalist Design	3	Create a clearer layout or site map and add sufficient guidance to help prospective students navigate the system easily.
8	When errors occur, reporting can only be done through USDI Care, which sometimes has slow response times. For faster resolution, personal reporting remains the preferred option.	Help Users Recognize, Diagnose, and Recover from Errors	3	Improve customer service by adding more reporting menus and speeding up response times, as well as providing faster and more accessible reporting options.

3.4. Integrated Discussion

The integration of findings from Webuse and Heuristic Evaluation demonstrates a mixed-method triangulation. While Webuse reflects end-user perceptions indicating high satisfaction (“Excellent”), the heuristic evaluation reveals structural usability issues with high severity, especially related to performance, error prevention, and design consistency. This divergence suggests that user-perceived usability does not fully capture expert-detected problems, highlighting the importance of combining subjective (user-based) and objective (expert-based) methods. Therefore, the mixed-method approach strengthens the validity of conclusions by integrating complementary perspectives.

3.4.1. User-Based Evaluation: Webuse After Outlier Removal

After removing 34 outliers, the Webuse results consistently placed all usability dimensions in the “Excellent” category. The before–after comparison shows that outlier removal reduced inflated scores by 0.03–0.05 points while keeping the categorical interpretation unchanged, indicating that monotonic respondents had elevated satisfaction levels. With 66 valid responses, the Webuse scores more accurately reflect genuine user perceptions, showing that SIMAK is viewed as easy to use, visually clear, and functionally accessible.

These results align with Agustina et al. [2] and Gerhana et al. [15], who also reported high Webuse satisfaction scores, particularly in readability and navigation. However, contrasting evidence appears in Putra et al. [13] and Listiya [16], who found that systems with structural usability flaws may still receive positive user evaluations in certain dimensions. These differences suggest that contextual factors—such as user familiarity with SIMAK, the relatively simple nature of routine tasks, and institutional expectations—may contribute to more favorable user assessments.

Although the Webuse evaluation indicates that SIMAK performs at an excellent level from the user perspective, stakeholders should not rely solely on these results. The presence of inflated satisfaction scores prior to outlier removal hints at potential familiarity bias and limited user awareness of deeper interface issues. Thus, improving user education and providing clearer operational guidance remain important to ensure that students can fully and effectively utilize the system.

3.4.2. Expert-Based Evaluation: Heuristic Findings

The heuristic evaluation conducted by four experienced evaluators identified 19 usability issues across Nielsen's heuristic principles, several of which held high severity ratings. The most prominent issues were related to system responsiveness under high traffic, incomplete error prevention mechanisms, inconsistent icons and interface layout, and insufficient support for recovering from errors. These findings highlight structural and functional weaknesses that users may not consciously detect during normal interaction.

Consistent with Danil and Hasibuan [14] and Penha et al. [9], the heuristic evaluation proved effective in uncovering hidden usability issues that are often overlooked in user-based assessments. This reinforces the notion that heuristic analysis provides depth and diagnostic insight beyond what subjective ratings alone can capture.

3.4.3. Reconciling Contradictions Between User and Expert Results

A major finding of this study is the stark contrast between high Webuse ratings and the significant number of heuristic issues. This contradiction suggests several underlying causes. First, respondent familiarity bias may influence users to rate the system more positively because they have adapted to its limitations or perceive it as a standard institutional tool. Second, questionnaire design bias inherent in Webuse—dominated by positively phrased items—can lead to lenient scoring patterns, especially among students accustomed to routine administrative tasks. Third, demographic characteristics such as the respondents being postgraduate students may contribute to higher confidence in navigating academic systems, reducing their sensitivity to deeper usability flaws.

This divergence matches patterns found in previous literature. Webuse often yields strong usability ratings even when structural issues exist [2], [15], whereas heuristic evaluation reveals the underlying interface weaknesses [13], [16]. The contrast between user-perceived and expert-validated usability underscores that Webuse alone may overestimate system quality. Therefore, integrating user-based and expert-based evaluations becomes essential for achieving a complete and reliable picture of SIMAK's usability.

3.4.4. Implications for System Improvement and Methodology

The combined findings highlight the need for both practical improvements and methodological refinement. Practically, addressing the high-severity issues identified by heuristic evaluation is critical for enhancing SIMAK's long-term effectiveness. The recommended improvements include:

1. Enhancing system performance to maintain responsiveness under peak usage, in line with Listiya [16].
2. Improving notifications and user guidance to reduce input errors, as emphasized by Maksum et al. [6].
3. Refining interface elements, such as icon–menu alignment and layout clarity, supporting the insights of Ginting et al. [12].
4. Strengthening user support services by adding faster reporting mechanisms and improving response times, following recommendations by Fachruzi [8].

Methodologically, these results demonstrate the necessity of using a mixed-method approach. Outlier removal significantly improved the validity of user-based data, Webqual comparison clarified measurement consistency, and heuristic evaluation provided expert diagnostic depth. Together, these

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elements show that relying solely on user questionnaires can lead to overly positive interpretations, whereas integrating multiple evaluation methods yields a more comprehensive and accurate usability assessment.

CONCLUSION

This study evaluated the usability of the Sistem Informasi Manajemen Akademik (SIMAK) at Udayana University using an integrated approach combining Webuse, outlier identification, and Heuristic Evaluation. From the initial 100 respondents, 34 monotonic outliers were removed, resulting in 66 valid datasets. After outlier filtering, all Webuse dimensions remained in the "Excellent" category, indicating that users generally perceive SIMAK as easy to use, visually clear, and functionally effective. However, the heuristic evaluation identified 19 usability issues—eight with high severity—related to system responsiveness, error prevention, interface consistency, and user support. This discrepancy shows that user-perceived satisfaction does not fully capture expert-validated system limitations.

The distinctive scientific contribution of this study lies in proposing a replicable integrated usability assessment framework consisting of:

1. Outlier-based data cleaning to improve questionnaire validity.
2. Cross-method comparison between Webuse and Webqual to assess measurement consistency.
3. Expert-based heuristic diagnosis to identify structural usability problems.

This combined framework provides a more robust and comprehensive evaluation strategy compared to relying solely on self-reported questionnaires, making it suitable for future usability assessments of academic information systems.

Despite these contributions, several limitations must be acknowledged. The removal of 34% of survey responses—although statistically justified—increases the risk of sample bias and may reduce the generalizability of the results. The study also focused exclusively on postgraduate students, which limits demographic diversity, and it relied on only one qualitative method (heuristics), which may not capture all interaction nuances. Future research should involve broader user groups, apply additional usability instruments such as SUS or UEQ for cross-validation, and perform longitudinal assessments to examine how iterative improvements affect long-term system adoption.

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