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Evaluation of Website Performance and Usability Using GTMetrix, Usability Testing, and System Usability Scale (SUS) Methods

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ABSTRACT

This study was conducted to measure the performance of IAIN Metro's website in terms of performance and user perception to ensure that the campus website can adequately support visitors' needs. This study aims to determine things that need to be improved to improve the performance of the IAIN Metro website. To get comprehensive results from the performance of the website, this research uses GTMetrix to analyse the technical performance of the IAIN Metro website, and then, to test user perceptions, researchers use Usability Testing and System Usability Scale methods. In usability testing, several aspects will be measured to determine usability problems, namely learnability and efficiency, while the System Usability Scale questionnaire will be used to test the satisfaction level. Based on the test results using GTMetrix, after testing, several aspects of the access speed of the IAIN Metro website need to be improved. Although, in general, from the test results, Usability Testing and System Usability Scale users still consider the performance of the website to be acceptable, the results of the first task on Time Based Efficiency testing show that initial access to the main page metrouniv.ac.id, takes a relatively long time compared to other tasks. This is also evident from the GTMetrix score on the performance aspect, which has a low presentation of 25%. Therefore, optimisation is needed on the main page to improve website performance.

Keywords : *GTMetrix; usability testing; System Usability Scale; IAIN metro website;*

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1. INTRODUCTION

Good website performance is needed so that visitors get the information they want and get a good experience when using the website. The customer experience when using a product, service, or service, in this case, a website, depends on every interaction aspect. To achieve increased satisfaction and loyalty, it is important to ensure that the product has use value and is easy to use[1]. The website serves as a means to convey information and promote the product so that the product can be known and reached by the public at large [2]. This research was conducted to measure the performance of IAIN Metro's website in terms of performance and user perception to ensure that the campus website can support the needs of visitors adequately. The Usability Testing and the System Usability Scale (SUS) are widely used to conduct research related to performance testing and system/website performance. Justin Mifsud-founder of Usability Geek, the ISO 9241-11 standard, defines usability as 'the extent to which a product can be used by specific users to achieve specified goals with effectiveness, efficiency, and satisfaction in the context of use.' The effectiveness, efficiency, and satisfaction possessed by usability are not dimensional properties but rather a combination of several factors. The ISO/IEC 9126-4 metrics recommend usability should include [3]

1. Effectiveness, i.e., the precision with which the user achieves the specified goals
2. Efficiency, i.e., the resources associated with accuracy and used by the user to achieve the goal.
3. Satisfaction, namely user comfort, and acceptance.

Some of these studies include research conducted by Sekar Arum Wulandari, who used the System Usability Scale (SUS) to analyse Mobile News Releases [4]. Research conducted by Ahmad Haidar Misa, who conducted usability testing of the Senja Muba application using the System Usability Scale, the study used a questionnaire that referred to the use of Questionary with the System Usability Scale (SUS) [5] Research conducted by Rihadatul Aisy et al. Evaluation of Usability of Side Mobile Applications Using Usability Testing Methods and System Usability Scale (SUS) [6] The study conducted a usability evaluation consisting of aspects of learnability, efficiency, error, and satisfaction. It used the System Usability Scale (SUS) to determine the quantitative score of side Mobile users. Likewise, the use of GTMetrix as a tool for testing website performance research conducted by Teresa Irma

Nangameka, which tests the quality of local government websites using GTMetrix [7]. Research by Randi Rizal to measure the performance of new student admission information systems using GTMetrix, WebAIM, and LoadView. Seeing from some of the above research to get things that need to be improved to improve the performance of the Institut Agama Islam Negeri Metro website, researchers will use GTMetrix as a tool for testing in terms of performance and Usability Testing, System Usability Scale (SUS) from user perception.

2. METHODS

This research was conducted through several systematic steps. The first step is formulating a problem based on the predetermined topic and research objectives. The second step involves a literature study, where references from books and scientific articles are used to understand the subject and topics to be discussed more deeply. Next, technical performance testing of the website is carried out, followed by user perception testing through Usability Testing and System Usability Scale (SUS) methods. The final step is to draw conclusions from the test results and suggest further development.

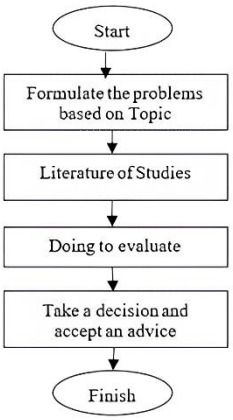

Figure 1. *Research process*

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The process of Usability Testing the IAIN Metro website begins by determining a series of tasks that respondents must complete,

Table 1. *Usability testing task*

No	Task	Task Code
1	Open the IAIN Metro website: https://metrouniv.ac.id	T1
2	Accessing the Program Sarjana menu	T2
3	Accessing News menu	T3
4	Accessing the Seleksi Masuk menu	T4

The tasks selected are activities commonly used by users when visiting the IAIN Metro website, which includes visiting the home page, searching for study program information, searching for student admission selection information, and accessing campus news; each task selected is based on the natural function of a website so that the results obtained will provide a comprehensive overview of the website user experience. According to Jakon Neilsen, the key components of Usability Testing are Learnability, Efficiency, and satisfaction [8]. The following is a table of Usability Testing Aspects and parameters used.

Table 2. *Usability testing parameters*

No	Aspects	Parameter
1	*Learnability*	*Success Rate*
2	*Efficiency*	*Time-Based Efficiency, Overall Relative Efficiency*.
3	*Satisfaction*	Skor *System Usability Scale* (SUS)

Learnability testing uses the success rate parameter using equation 1 below:

$$Success\ Rate = \frac{(S+(P \times 0{,}5))}{Total\ Task} \text{ x } 100\ \% \qquad (1)$$

Explanations :
S = *Success Task*
P = *Partial Succsess*

Efficiency aspect testing uses Time Based Efficiency and Overall Relative Efficiency parameters. Below Equation 2 Time Based Efficiency and Equation 3 Overall Relative Efficiency

$$Time\ Based\ Efficency = \frac{\sum_{j=1}^{R}\sum_{i=1}^{N}\frac{n_{ij}}{t_{ij}}}{NR} \qquad [9]\ (2)$$

$$Overall\ Relative\ Efficiency = \frac{\sum_{j=1}^{R}\sum_{i=1}^{N} n_{ij}t_{ij}}{\sum_{j=1}^{R}\sum_{i=1}^{N} t_{ij}} \times 100\% \qquad (3)$$

Explanations :
$\boldsymbol{N}$ = The Number Of Task (Goals)
$\boldsymbol{R}$ = The Number of users
$\boldsymbol{Nij}$ = The result of task i by user j; if the user successfully completes the task,then Nij 1,if not,then Nij = 0
$\boldsymbol{Tij}$ = The time spent by user j to complete task i.If the task is not successfully completed,then time is measured till the moment the user quits the task

Testing is carried out using devices commonly used by website visitors, namely laptops and mobile phones. Techniques and determining this test environment are needed in order to get real results, as done by Rizqy Anwar Hidayatullah et al. [11]. The test result data is obtained through direct observation when the respondent is doing the task, and after completing the task, the respondent will fill out the System Usability Scale questionnaire. To carry out this test, the researcher used a questionnaire filled out by the respondents, which contained 10 System Usability Scale questions [12]. The following is a questionnaire that will be distributed to the respondents. The number of respondents in this study involved eight students and eight lecturers. According to Nielsen, 5 to 8 respondents per user group is the ideal number to represent each segment [13].

Table 3. System Usability Scale Form

No	Questions
1	I think, that I would like to use this website frequently.
2	I found the website unnecessarily complex.
3	I think, the website is easy to use
4	I think I need other people to help me use this website
5	I found so many menus on website which integrated well.
6	I felt so many things on website which not consist
7	I would imagine that most people would learn to use this website very quickly.
8	I found the website is not easy to use
9	I can use the website surely.
10	I should study many things about the website before use.

Using the GTMetrix method to measure technical aspects related to website access speed [14] complements the more thorough usability testing results related to website performance. Some previous studies have also been conducted to test website performance, including research conducted by Ayu Anggraini et al., who used the System Usability Scale to test the threads application [15], research

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conducted by Adelia Rizma Reyhana Putri et al., who used Usability Testing and System Usability Scale to evaluate the user interface and user experience [16] the use of Usability Testing and System Usability Scale is commonly used to test website performance.

3. RESULTS AND DISCUSSION

This section presents the results of testing conducted using two approaches, namely technical performance testing and user perception testing. Technical performance testing was performed using GTMetrix, which measures metrics such as load speed and website structure efficiency. Meanwhile, user perception testing involves Usability Testing and System Usability Scale (SUS) methods, which provide an overview of website user satisfaction and experience. Here are the details of the test results that have been carried out.

3.1. Website Technical Performance Testing

GTMetrix evaluates website quality in terms of performance and provides recommendations for improvement. In this test, the researcher used a free GTMetrix account, so the server location chosen was Sydney, the closest location to Indonesia. The test was conducted using the Chrome browser with the average connection conditions of mobile phone users in Indonesia, namely the 4G network. The following are the test results using GTMetrix.

Figure 2. *GTMetrix testing results*

Based on the evaluation results, IAIN Metro's website received an F in performance and structure. This score represents the direct user experience measured through the GTMetrix platform. This performance assessment indicates significant weaknesses in the speed and efficiency of website access. The following is a breakdown of the performance metrics measured, including page load speed, server response time, and overall page size.

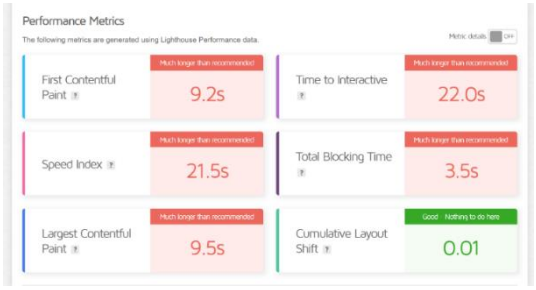

Figure 3. *Performance metrics assessment results*

Table 4. *Structure assessment results*

High	Eliminate render-blocking resources
High	Avoid enormous network payloads LCP.
High	Reduce initial server response time FCP LCP.
High	Enable text compression FCP LCP
High	Avoid chaining critical requests FCP LCP.
High	Avoid long main-thread tasks TBT.
Med-High	Avoid an excessive DOM size TBT.
Med	Use a Content Delivery Network (CDN)
Med	Reduce unused CSS FCP LCP
Med-Low	Lazy load third-party resources with facades TBT
Med-Low	Reduce unused JavaScript LCP
Med-Low	Use HTTP/2 for all resources.
Low	Minify CSS FCP LCP
Low	Serve static assets with an efficient cache policy.
Low	Allow back/forward cache restoration.
Low	Reduce JavaScript execution time TBT.
Low	Properly size images
Low	Minify JavaScript FCP LCP
Low	Serve images in next-gen formats.
Low	Avoid non-composited animations CLS.
Low	Defer offscreen images
Low	Avoid multiple page redirects FCP LCP.
N/A	Minimise main-thread work TBT.
N/A	Avoid serving legacy JavaScript to modern browsers TBT.
N/A	Largest Contentful Paint element LCP.
N/A	Avoid significant layout shifts CLS.
N/A	User Timing marks and measures.
N/A	Reduce the impact of third-party code TBT.

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Figure 4. *Waterfall assessment results*

Table 5. *GTMetrix improvement recommendations*

No	Suggested Improvements
1	Eliminate render-blocking resources. Resources block the first paint of your page. Consider delivering critical JS/CSS inline and deferring all non-critical JS/styles.
2	Avoid enormous network payloads, Large network payloads cost users real money and are highly correlated with long load times.
3	Reduce initial server response time, Keep the server response time for the main document short because all other requests depend on it.
4	Enable text compression, Text-based resources should be served with compression (gzip, deflate or brotli) to minimize total network bytes.
5	Avoid chaining critical requests.

Based on the results of the technical performance testing, IAIN Metro's website received a grade F, which indicates that some technical aspects need to be improved to improve the quality of the website. Furthermore, researchers will conduct testing using Usability Testing and System Usability Scale (SUS) methods to evaluate whether the technical issues also affect user perception and experience.

3.2. Testing User Perception

To measure the technical performance of user perception, researchers used Usability Testing and System Usability Scale (SUS) methods. The first step in usability testing is to give tasks to respondents to complete. In this study, 8 students, 8 lecturers, and employees were used as respondents.

a. Learnability

This test is conducted to determine the ease of users in using the system [17] to calculate the level of learnablitiy using equation 1 below:

$$Success\ Rate = \frac{(S+(P \times 0{,}5))}{Total\ Task} \text{ x } 100\ \% \qquad (4)$$

Explanations :

S = *Success Task*

P = *Partial Succsess*

Table 6. *Learnability*

Responden	T1	T2	T3	T4	T5
1	S	S	S	S	S
2	S	S	S	S	S
3	S	S	S	S	S
4	S	S	S	S	S
5	S	S	S	S	S
6	S	S	S	S	S
7	S	S	S	S	S
8	S	S	S	S	S
9	S	S	S	S	S
10	S	S	S	S	S
11	S	S	S	S	S
12	S	S	S	S	S
13	S	S	S	S	S
14	S	S	S	S	S
15	S	S	S	S	S
16	S	S	S	S	S

Furthermore, from the data above, the Successrate calculation is carried out with equation 1 and the results are obtained

$$Success\ Rate = \frac{(64+(0\ x\ 0{,}5)}{64} \text{ x } 100\ \% = 100\% \quad (5)$$

b. Efficiency

Efficiency is how quickly users can complete a task once they learn how to use the product or system. Efficiency can be calculated in two ways, namely by using the Time Based Efficiency equation and Overall Relative efficiency.

Equation 2:

$$Time\ Based\ Efficency = \frac{\sum_{j=1}^{R}\sum_{i=1}^{N}\frac{n_{ij}}{t_{ij}}}{NR} \qquad [9]\ (6)$$

Explanations :

N	=	The Number Of Task (Goals)
R	=	The Number of users
Nij	=	The result of task i by user j; if the user successfully completes the task,then Nij 1,if not,then Nij = 0
Tij	=	The time spent by user j to complete task i.If the task is not successfully completed,then time is measured till the moment the user quits the task

In the table below, the n_{ij} value will be 1 if the job is done successfully and 0 when it is not.

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Tabel 7. *Efficiency task*

Respondence	T1	T2	T3	T4	T1 *Nij/ Tij*	T2 *Nij/ Tij*	T3 *Nij/ Tij*	T4 *Nij/ Tij*	Total
1	17	4	5	3	0,06	0,25	0,20	0,33	0,51
2	17	4	3	3	0,06	0,25	0,33	0,33	0,64
3	15	4	4	3	0,07	0,25	0,25	0,33	0,57
4	19	12	6	3	0,05	0,08	0,17	0,33	0,30
5	90	13	4	4	0,01	0,08	0,25	0,25	0,34
6	20	6	3	2	0,05	0,17	0,33	0,50	0,55
7	10	11	5	4	0,10	0,09	0,20	0,25	0,39
8	20	5	6	15	0,05	0,20	0,17	0,07	0,42
9	15	7	3	1	0,07	0,14	0,33	1,00	0,54
10	100	11	10	7	0,01	0,09	0,10	0,14	0,20
11	100	10	10	7	0,01	0,10	0,10	0,14	0,21
12	16	7	6	5	0,06	0,14	0,17	0,20	0,37
13	7	6	3	5	0,14	0,17	0,33	0,20	0,64
14	12	10	5	6	0,08	0,10	0,20	0,17	0,38
15	24	6	5	4	0,04	0,17	0,20	0,25	0,41
16	8	6	8	12	0,13	0,17	0,13	0,08	0,42
Average									**6,89**

$$\textit{Time Based Efficency} = \frac{6{,}89}{64} \quad \text{TBE} = 0{,}107 \textit{ goals/second} \tag{7}$$

Each task completed by the respondents was then analysed using the Overall Relative Efficiency formula.
Equation 3

$$Overall\ Relative\ Efficiency = \frac{\sum_{j=1}^{R}\sum_{i=1}^{N} n_{ij}t_{ij}}{\sum_{j=1}^{R}\sum_{i=1}^{N} t_{ij}} \times 100\% \tag{8}$$

Explanations :

N	=	The Number Of Task (Goals)
R	=	The Number of users
Nij	=	The result of task i by user j; if the user successfully completes the task,then Nij 1,if not,then Nij = 0
Tij	=	The time spent by user j to complete task i.If the task is not successfully completed,then time is measured till the moment the user quits the task

Table 8. *Overall relative efficiency*

R	T1	T2	T3	T4	T1 *Nijx Tij*	T2 *Nijx Tij*	T3 *Nijx Tij*	T4 *Nijx Tij*	Total
1	17	4	5	3	17	4	5	3	29
2	17	4	3	3	17	4	3	3	27
3	15	4	4	3	15	4	4	3	26
4	19	12	6	3	19	12	6	3	40
5	90	13	4	4	90	13	4	4	111
6	20	6	3	2	20	6	3	2	31
7	10	11	5	4	10	11	5	4	30
8	20	5	6	15	20	5	6	15	46
9	15	7	3	1	15	7	3	1	26
10	100	11	10	7	100	11	10	7	128
11	100	10	10	7	100	10	10	7	127
12	16	7	6	5	16	7	6	5	34
13	7	6	3	5	7	6	3	5	21
14	12	10	5	6	12	10	5	6	33
15	24	6	5	4	24	6	5	4	39
16	8	6	8	12	8	6	8	12	34
Total									**782**

So that it becomes

$$\textit{Overall Relative Efficiency} = \frac{782}{782} \text{ x } 100\% = 100\% \tag{9}$$

The total score of all tasks is divided by the number of tasks given. Next, the average of all respondents' scores was calculated to get the overall efficiency result of the usability testing. The calculation results show an efficiency level of 100%, which indicates that the IAIN Website application is efficient.

c. Satisfaction

To conduct satisfaction testing, researchers used a questionnaire to be filled out by respondents containing 10 System Usability Scale questions [12], the following are the results of questionnaires that respondents have filled out

Table 9. *The scale usability scale point system*

Respondence	Questions										Total
	1	2	3	4	5	6	7	8	9	10	
1	3	4	3	4	3	3	3	3	4	4	34
2	4	2	4	3	4	2	5	2	4	4	34
3	5	2	5	3	5	2	5	3	4	4	38
4	4	3	4	3	3	3	4	3	4	3	34
5	3	2	4	3	3	3	4	3	5	4	34
6	4	4	4	3	4	3	4	2	3	3	34
7	4	3	4	4	4	3	4	1	3	2	32
8	3	4	3	3	3	3	4	3	4	3	33
9	4	2	4	2	4	3	5	2	3	2	31
10	4	3	4	3	3	3	4	4	4	3	35
11	4	1	5	1	3	1	5	1	4	3	28
12	5	2	5	3	4	2	4	2	3	4	34
13	5	2	4	2	4	2	4	2	4	3	32
14	4	2	3	2	3	2	4	2	3	3	28
15	5	3	5	5	5	5	5	5	5	5	48
16	4	3	4	3	2	3	2	2	3	1	27

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Equation 4

SUS Score = Total Answer x 22,5 [18] (10)

Table 10. *The result of usability scale*

Respondence	Total	Nilai	Result
1	35	35x 22,5	87,5
2	32	32x 22.5	80
3	34	34 x 22.5	85
4	36	36 x 22.5	90
5	42	42 x 22.5	105
6	28	28 x 22.5	70
7	29	29 x 22.5	72,5
8	30	30 x 22.5	75
9	26	26 x 22.5	65
10	29	29 x 22.5	72,5
11	36	36 x 22.5	90
12	26	26 x 22.5	65
13	26	26 x 22.5	65
14	34	34 x 22.5	85
15	32	32 x 22.5	80
16	31	31 x 22.5	77,5
Average			79,1

CONCLUSION

After measuring the performance of IAIN Metro's website from the technical side and user perception, the technical measurement results using GTMetrix showed that the website obtained a grade F. Based on these results, there are several recommendations for improvements that need to be made, including

Table 11. *GTMetrix improvement suggestions*

NO	Suggestions
1	Consider sending important JS/CSS directly and delaying all non-important JS/CSS.
2	Large network load burdens users. Keep server response time for key documents short, as all other requests depend on it.
3	Text-based resources should be served with compression (gzip, deflate or brotli) to minimize total network bytes.
4	Consider reducing chain length, reducing resource download size
5	delay the download of unnecessary resources to improve page loading.

User perception testing through Usability Testing and System Usability Scale (SUS) provides the following results: The Learnability aspect shows a Success Rate of 100%, which means that all tasks given to respondents are successfully completed. In the Efficiency aspect, the Time-Based Efficiency result is 0.107 goals/second, meaning that each respondent completes 0.107 tasks per second on average. In addition, Overall Relative Efficiency reached 100%, indicating that respondents completed the task with the maximum level of efficiency. For the Satisfaction aspect, the SUS score is 79.1%, which indicates that the website has a good level of usability; based on the curved grading scale (CGS) from Sauro-Lewis, this value is at grade -A [19]. Detailed test results can be seen in the table below.

Table 12. *Calculation results of usability aspects*

No	Aspect	Parameter	Outcome
1	*Learnability*	*Success Rate*	*Success Rate =100%*
2	*Efficiency*	*Time Based Efficiency, Overall Relative Efficiency.*	*TBE = 0,107 Goals/second ORE = 100%*
3	*Satisfaction*	Skor *System Usability Scale* (SUS)	*SUS Score* = 79,1%

Based on the test results using GTMetrix, it was found that some technical aspects of IAIN Metro's website, particularly access speed, need more attention. Although from the user's perspective, the Usability Testing and System Usability Scale (SUS) results still show that the website's performance is considered acceptable, the Time-Based Efficiency (TBE) test results on the first task (initial access to the metrouniv.ac.id main page) indicated a relatively long load time compared to other tasks. This is consistent with the results of the GTMetrix assessment on performance, which showed a low score of 25%. Therefore, optimisation of the main page is necessary to improve site performance.

The combined use of Usability Testing, SUS, and GTMetrix has provided an alternative test with a more comprehensive technical performance analysis and user experience. Previously, many studies have used usability testing and SUS to evaluate website performance and usability, focusing on user perception without paying in-depth attention to technical aspects. However, by adding GTMetrix, these tests provide a more comprehensive view, including technical aspects such as access speed and page structure. This research provides an alternative method for website performance evaluation by integrating GTMetrix testing, which allows for a more detailed identification of technical performance issues.

In future research, additional methods such as the User Experience Questionnaire (UEQ) are expected to provide a more holistic view of the quality of user experience on campus websites. The website performance assessment will be more thorough by combining technical measurements from GTMetrix, user perception through the System Usability Scale (SUS), and user experience evaluation through UEQ. This will help identify not only the technical and usability aspects but also the quality of user experience, which is important for optimizing the website's sustainability.

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