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Usability Analysis of Atma Jaya Catholic University E-Learning Based on Human Computer Interaction

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Abstract

E-learning UAJ is a system provided by Unika Atma Jaya to facilitate the learning process for both students and lecturers. However, this system is still rarely used, especially among engineering faculties. This forms the basis for conducting the following analysis. The purpose of this research is to measure the level of usability of the UAJ e-learning system. Usability analysis is carried out using five components of usability outlined by Jakob Nielsen: Learnability, Efficiency, Memorability, Errors, and Satisfaction. The indicators within these five components are then compiled into a questionnaire, which will be distributed to active lecturers and students across all faculties who utilize the UAJ e-learning platform. This study employs a Likert scale with five categories, ranging from category 1 indicating "very bad" to category 5 indicating "very good." Among the five usability criteria assessed for both students and lecturers, the majority of responses fell within category 3, indicating sufficiency. The average scores ranged from 14.122 to 18.731 for lecturers and from 19.825 to 21.845 for students. Overall, the usability level of the UAJ e-learning platform is deemed satisfactory, enabling more effective utilization by both lecturers and students. Additionally, the study results propose several solutions for enhancing the development of the UAJ e-learning system.

Keywords: e-learning, usability, HCI

1. INTRODUCTION

Currently, the rapid development of technology is increasingly influencing various sectors, including the education sector. According to data quoted from Google Trends (Online Learning - Explore - Google Trends, n.d.), throughout the years 2020 to 2022, searches using the keyword "online learning" experienced an increase. Based on the graph in Figure 1, searches using the keyword "online learning" first experienced an increase in March 2020 with a popularity level of 48 and reached its peak in October 2020 with a popularity level of 100. Based on this data, it can be concluded that discussions related to online learning have been sought by the public since 2020.

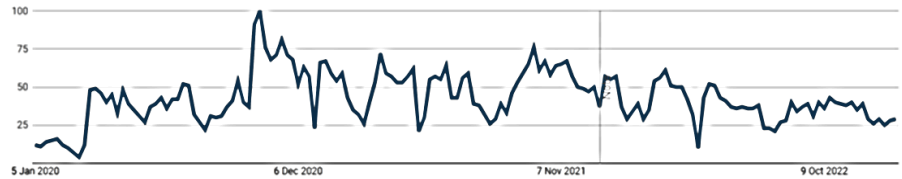

Figure 1. Search results for keyword online learning (Google Trends)

One of the systems currently widely used in online learning is the e-learning system. This system is commonly used, especially by educational institutions such as universities. The term "E" or electronic in e-learning is used as a term for all forms of technology used to support teaching efforts through internet-based electronic technology [1]. Atma Jaya is one of the universities that utilizes the e-learning system in its teaching and learning processes. The Atma Jaya e-learning system is a learning model that can be used by both students and lecturers for their academic needs. Students and lecturers can access the Atma Jaya e-learning platform through https://elearning.atmajaya.ac.id. Based on interviews with several lecturers from the Information Systems program, the Atma Jaya e-learning system has been functioning well, but it is still not widely utilized. One of the lecturers from the Information Systems program mentioned that the Atma Jaya e-learning system has experienced occasional downtimes, which has caused some hindrances in their work.

Human-Computer Interaction (HCI) is a field of study that focuses on the interface between humans and computers [2]. This field typically involves humans as users of computer devices, and machines as tools used by humans [3]. HCI is concerned with understanding how computers can be designed to be used effectively and efficiently [4]. In HCI, usability plays a crucial role as a measure of how well a system functions in terms of effectiveness, efficiency, and user satisfaction [5]. Usability is an indicator that shows the measure of suitability of a system [6]. There are several contexts used to measure the suitability of a system, such as effectiveness, efficiency, and user satisfaction [7]. Usability classified usability into 5 dimensions, namely Learnability, Efficiency, Memorability, Errors, and Satisfaction [8]. These five dimensions will be used as criteria to assess the usability level of the Atma Jaya e-learning system. The purpose of this research is to measure the usability level of students and lecturers across the Atma Jaya University campus regarding the Atma Jaya e-learning system based on Human-Computer Interaction (HCI).

There are several previous studies that serve as references for conducting this research. A study aimed to analyze the usability of the user interface design on the Tokopedia e-commerce website using the Heuristic Evaluation method [9]. Another study aimed to determine the level of usability on the e-commerce

website used by PT.24 Jam Online (UniPin) [10]. This research was conducted using the usability testing method, employing the Nielsen Attributes of Usability (NAU) questionnaire, and conducting interviews with UniPin website users.

Meanwhile, a study aimed to analyze the usability of the Edlink mobile application, which was developed by PT. SEVIMA to assist students and lecturers in conducting online learning activities. This research was conducted using the heuristic evaluation method and involved 40 questions as evaluation materials [11]. Another study aimed to prove that the MyTelkomsel application has good usability. The researcher used the Jakob Nielsen Usability model, which consists of 5 indicators, to test the usability of the application [12]. The last study aimed to measure the usability and accessibility level of an e-commerce platform using visually impaired individuals as their respondents [13]. This research was conducted by distributing two types of questionnaires. The first questionnaire was used to measure the level of computer literacy and how often the respondents use technology and the purpose of using that technology. The second questionnaire utilized the SUMI (Software Usability Measurement Inventory) template, which is divided into five sections: website structure, navigation, user interface (UI), content, and overall assessment of the website.

2. METHODS

This study was conducted using a quantitative research method and a descriptive analysis model, employing IBM SPSS 25 as the tool. There were five stages in this research, namely Determining the Strategy, Data Collection, Validity Test, Reliability Test, Data Processing, and Conclusion, as shown in Figure 1.

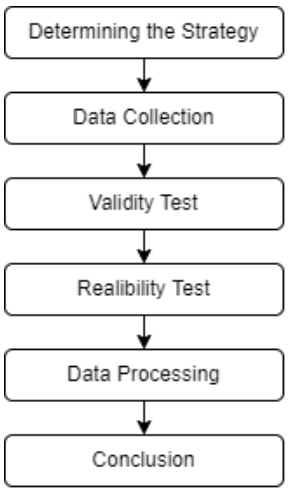

Figure 2. Research methodology

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2.1. Determining the Strategy

In this stage, a literature review will be conducted. Literature review is a form of gathering various literature materials that will be used for research purposes [14]. In this stage will collects journals, books, articles, and similar research studies related to the analysis of usability using the HCI learning model and the Jakob Nielsen usability model. In this study, the variables used are Learnability, Efficiency, Memorability, Errors, and Satisfaction.

2.2. Data Collection

In this stage, the sample and population that will be used as the target respondents in the survey are determined. The population used in this research is all active students and lecturers from all campuses of Unika Atma Jaya in the odd semester of 2022. The data used as the population is collected from the official government website PDDikti (Higher Education Database).

Sample is a small part or subset of the population with the qualities and characteristics required by the researcher [15]. The sample is also used as a representation of a population to meet the data needs of the research [16]. In this research, two calculations are performed. The first calculation is conducted to determine the number of student respondents, while the second calculation is done to determine the number of lecturer respondents. In determining the sample for this research, the Slovin's formula is used, as shown in Equation 1.

$$n = \frac{N}{1+Ne^2} \quad (1)$$

Where:
n = Sample size
N = Population size
e = Margin of Error

This research uses a Non-probability Sampling technique with the Purposive Sampling model. Purposive Sampling is a sampling technique based on specific considerations or selective criteria [17]. The selection process is carried out by establishing criteria that will be used as a benchmark in this research. In the Purposive Sampling technique, the researcher needs to determine the criteria of the respondents to be analyzed. The predetermined criteria for the respondents are as follows.

1. Have an e-learning UAJ account.
2. Have used the features available on e-learning UAJ.
3. Use features such as Private files, My courses, and Calendar on e-learning UAJ at least once a month.

In this questionnaire, a Likert scale is used to measure the respondents' answers. The Likert scale is a scale used to measure the attitudes, opinions, and perceptions

of an individual or group towards an object/attitude [18]. The Likert scale allows us to assess the level of agreement from respondents based on their responses to a question. In this research, a 1-5 scale is used, where 1 represents the statement "strongly disagree" and 5 represents the statement "strongly agree." The Likert scale used in this study can be seen in Table 1.

Table 1. Indicator of likert scale

Scale	Category
1	Totally Disagree
2	Don't Agree
3	Neutral
4	Agree
5	Strongly Agree

2.3. Validity Test

Validity testing is a tool used to determine the validity of a research questionnaire [19]. Validity testing aims to assess whether the indicators used adequately represent each variable [20]. In this study, the first 30 data points are selected to be used for testing the validity of the questionnaire using the Pearson Product Moment formula. The formula for Pearson Product Moment can be seen in equation (2).

$$r = \frac{\Sigma((X-\bar{X})(Y-\bar{Y}))}{\sqrt{\Sigma(X-\bar{X})^2 \Sigma(Y-\bar{Y})^2}} \quad (2)$$

Where:

r = Pearson correlation coefficient
X and Y = Variables being correlated
$\bar{X}$ and $\bar{Y}$ = Means of variables X and Y

2.4. Reliability Test

Reliability testing is a tool used to measure the reliability of a questionnaire, which serves as an indicator of the variables or research model [21]. A questionnaire can be considered reliable if the responses obtained from respondents yield consistent/stable results. In calculating the reliability value, researchers use Cronbach's Alpha as a measurement tool [20]. If the value of Cronbach's Alpha is ≥ 0.6, the questionnaire can be considered to have a good level of reliability. The formula for Cronbach's Alpha can be seen in Equation (3).

$$a = \left(\frac{N}{N-1}\right)\left(1 - \left(\frac{\Sigma Variances\ of\ items}{Variance\ of\ total\ score}\right)\right) \quad (3)$$

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Where:
α = Cronbach's Alpha coefficient
N = Number of items (questions) in the questionnaire

3. RESULTS AND DISCUSSION

Here is the research instrument used to collect data. The respondents consist of students and lecturers. The determination of the number of respondents uses the Slovin formula with a margin of error of 7.5% for students and 15% for lecturers. The first calculation is done to determine the number of students who will be respondents. The calculation is performed using a margin of error of 7.5%.
n = N / (1 + (N * e^2))
n = 9874 / (1 + (9874 * 0.075^2))
n = 9874 / (1 + (9874 * 0.005625))
n = 9874 / (1 + 55.541)
n = 9874 / 56.541
n = 174.634

The second calculation is done to determine the number of lecturers who will be respondents. The calculation is performed using a margin of error of 15%.
n = N / (1 + (N * e^2))
n = 451 / (1 + (451 * 0.15^2))
n = 451 / (1 + (451 * 0.0225))
n = 451 / (1 + 10.1475)
n = 451 / 11.1475
n = 40.458

Based on the two sample calculations that have been conducted, the total sample size used in this research is 215 individuals, consisting of 175 students and 40 lecturers.

3.1. Distribution of Respondents

The distribution of respondents is primarily from the Faculty of Medicine and Health Sciences (FKIK), constituting 25% of the total with 10 participating lecturers. Following closely is the Faculty of Economics and Business (FEB) comprising 20%, involving 8 lecturers. The Faculty of Psychology (FP) and the Faculty of Education and Language (FPB) share an equivalent representation of 12%, encompassing 5 lecturers each. The Faculty of Law (FH) is accounted for by 10%, engaging 4 lecturers. Furthermore, the Faculty of Engineering (FT), Technobiology (FTB), and Business Administration and Communication Sciences (FAB) contribute equally with 7%, involving 3 lecturers from each respective faculty, as shown in Figure 3.

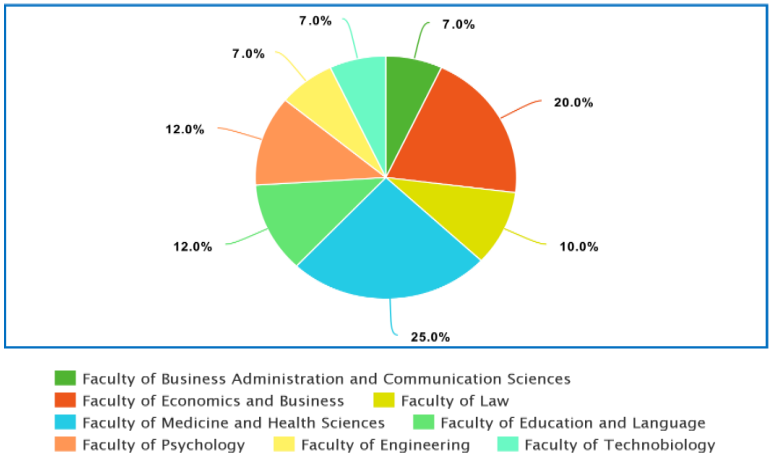

Figure 3. Respondent category based on faculty (Lecturers)

The distribution of respondents is predominantly composed of students from the Faculty of Engineering (FT), constituting 26% or a total of 51 students. Subsequently, the Faculty of Economics and Business (FEB) follows with a representation of 16%, involving 31 students. Additionally, students from the Faculty of Medicine and Health Sciences (FKIK) make up 12%, totaling 23 students, while the Faculty of Law (FH) and the Faculty of Business Administration and Communication Sciences (FAB) both encompass 11%, equivalent to 21 students each. Both the Faculty of Education and Language (FPB) and the Faculty of Technobiology (FTB) account for 10%, involving 20 students for each faculty. Furthermore, the Faculty of Psychology (FP) is represented by 7%, engaging a total of 14 students, as shown in Figure 4.

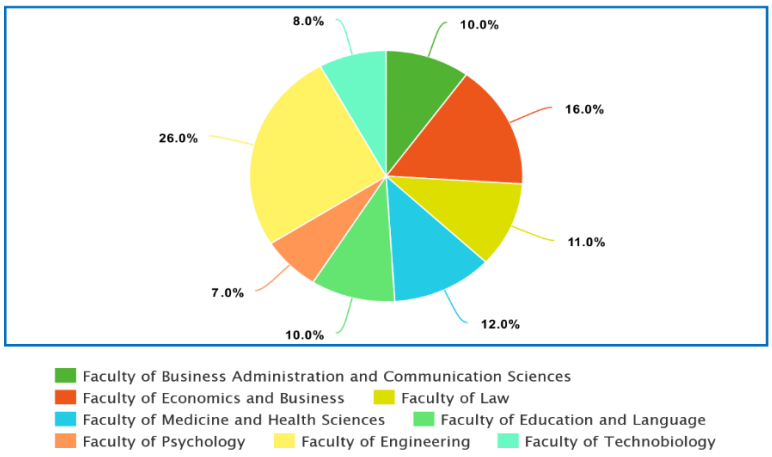

Figure 4. Respondent category based on faculty (Students)

3.2. Validity Result

The validity measurement of the e-learning Atma Jaya usability based on HCI was conducted using the Pearson Product Moment technique with the assistance of IBM SPSS Statistics 25. The critical value (r_{table}) used for the validity test of the lecturer respondents is 0.308. On the other hand, the critical value (r_{table}) used for the validity test of the student respondents is 0.138. If the calculated value (r) is greater than the critical value (r_{table}), then the indicator can be considered valid. Based on the calculation results, there are 30 valid items has a validity coefficient in the range of 0.522 up to 0.762.

3.3. Reliability Result

The reliability measurement of the e-learning Atma Jaya usability based on HCI was conducted using the Cronbach's Alpha technique with the assistance of IBM SPSS Statistics 25. In order for an item to be considered reliable, the reliability coefficient of that item should have a score ≥ 0.6. The results of the reliability calculation for lecturer 0.945 and student 0.936. Thus it can be said that the data is reliable.

3.4. Descriptive Analysis Results

The results of the descriptive analysis for lecturers can be seen in Table 2, while the results of the descriptive analysis for students can be seen in Table 3. In both tables, the indicators used as measurement tools are mean, median, min, max, and standard deviation

Table 2. Descriptive statistical analysis (Lecturer)

		Learnability	Efficiency	Memorability	Error	Satisfaction
N	Valid	41	41	41	41	41
	Missing	0	0	0	0	0
Mean		18.6098	18.1220	18.7317	14.1220	18.7073
Median		18.0000	18.0000	19.0000	14.0000	19.0000
Std. Deviation		2.56786	2.73126	2.54975	2.30429	2.48238
Minimum		15.00	10.00	13.00	6.00	12.00
Maximum		27.00	26.00	28.00	21.00	26.00

Table 3. Descriptive statistical analysis (Student)

		Learnability	Efficiency	Memorability	Error	Satisfaction
N	Valid	194	194	194	194	194
	Missing	0	0	0	0	0
Mean		18.6098	18.6098	21.6546	21.8454	21.7062
Median		18.0000	18.0000	21.0000	21.0000	21.0000
Std. Deviation		2.56786	2.56786	3.01796	3.01238	2.87949
Minimum		15.00	15.00	8.00	9.00	9.00
Maximum		27.00	27.00	30.00	30.00	30.00

To determine the high and low measurement results of the five usability criteria of the application used in this research, each criterion is categorized into 5 categories: very easy, easy, neutral, kinda hard, and hard. The determination of the interval width for each category is calculated by subtracting the lowest possible value from the highest possible value and dividing it by the number of categories. The equation (3) is used to determine the intervals for these 5 categories:

$$Interval = \frac{Maximum\ Score - Minimum\ Score}{number\ of\ categories} \quad (3)$$

The highest score in each item is 5 and the lowest score is 1, so the probabilities of the highest score and the lowest score will be as follows:

$$Interval = \frac{30-6}{5}$$
$$Interval = 4,8 \approx 5$$

Based on the results of the analysis, the following categories can be determined:

26 < x ≤ 30 : Very Easy
21 < x ≤ 25 : Easy
16 < x ≤ 20 : Neutral
11 < x ≤ 15 : Kinda Hard
6 < x ≤ 10 : Difficult

1) Learnability

Based on the results shown in Figure 5, it can be observed that both lecturer and student perceive that e-learning UAJ is relatively easy to learn. Some factors that contribute to the ease of learning e-learning UAJ are the user-friendly features provided by the system when users want to complete a task. When users want to accomplish a task, they simply need to click the ≡ button, and the system will display a sidebar containing various activities that can be performed by the users.

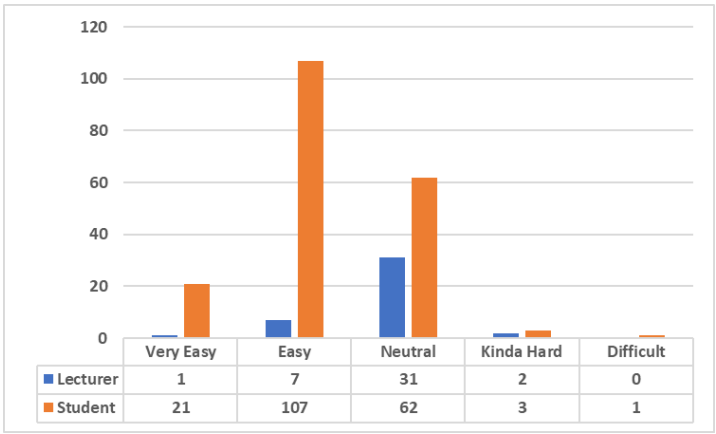

Figure 5. Bar chart for learnability criteria

2) Efficiency

Based on the results shown in Figure 6, it can be observed that both lecturer and student perceive that e-learning UAJ is efficient. Some factors that contribute to the efficiency of e-learning UAJ are its simple user interface (UI) design, which facilitates user understanding, recall, and navigation of the various features when accessing e-learning UAJ.

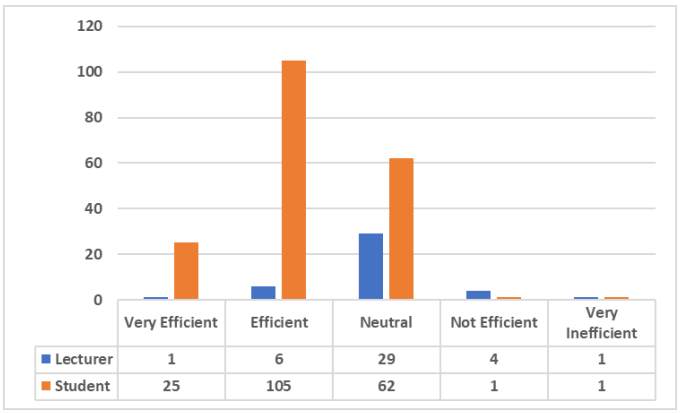

Figure 6. Bar chart for efficiency criteria

3) Memorability

Based on the results shown in Figure 7, it can be observed that both lecturer and student perceive that e-learning UAJ is easy to remember. Some factors that contribute to the ease of remembering e-learning UAJ are its UI design, which is considered to be well-designed. The icons used in e-learning UAJ have clear meanings, making it easier for users to remember them. e-learning UAJ also maintains consistent page layouts, as seen in the consistent placement of icons in the sidebar and navbar across different submenus available in e-learning UAJ.

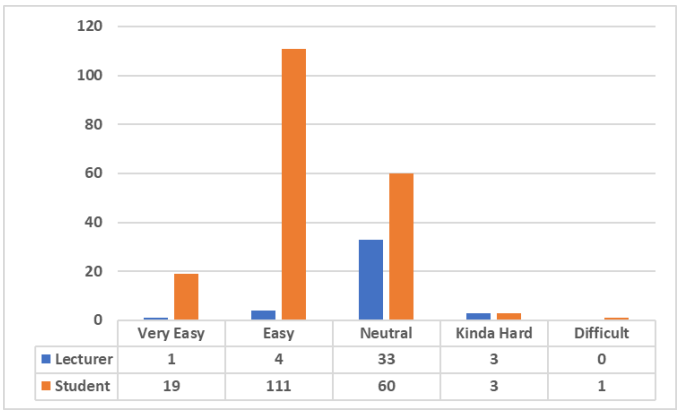

Figure 7. Bar chart for memorability criteria

4) Error

Based on the results shown in Figure 8, it can be observed that both lecturer and student perceive that e-learning UAJ has a relatively low error rate. Some factors contributing to the low error rate of e-learning UAJ include its system that assists users in resolving issues. To minimize the likelihood of users making mistakes while accessing the system, e-learning UAJ consistently provides error messages when users make errors, allowing them to promptly correct those mistakes.

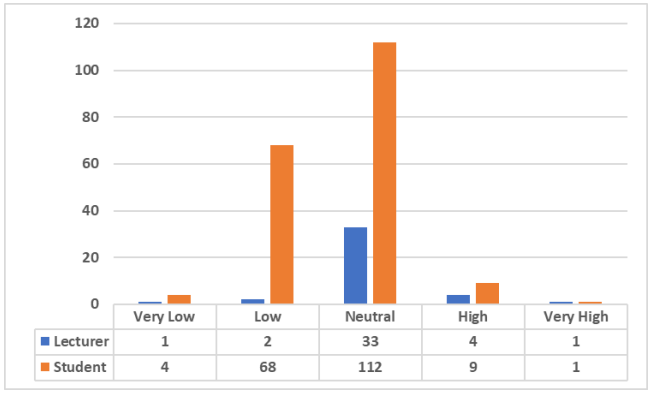

Figure 8. Bar chart for error criteria

5) Satisfaction

Based on the results shown in Figure 9, it can be observed that both lecturer and student express satisfaction with e-learning UAJ. Several factors contribute to respondents' satisfaction with e-learning UAJ, as indicated by their responses. The majority of respondents are satisfied with e-learning UAJ due to the ease of use provided by the system, the features offered by e-learning UAJ, and its ability to enhance user productivity. Users are also satisfied with the quality and relevance of the content provided by e-learning UAJ.

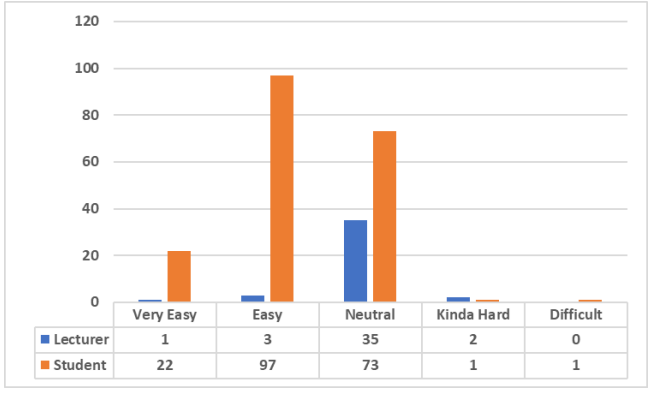

Figure 9. Bar chart for satisfaction criteria

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When discussed based on the 5 Usability criteria, the distribution of values for each variable can be seen in Figure 10 as follows:

Figure 10. Recapitulation of the analysis of each usability variable

The results of this research address important issues in the field of Human-Computer Interaction (HCI) with a focus on usability and user experience in the context of e-learning systems. There is a significant correlation between the findings of this article and five previous studies that have been presented. The first parallel study to this research concerns the awareness of the importance of a good user interface to ensure optimal interaction, which is also relevant in the context of e-learning. There is positive feedback regarding the efficiency and effectiveness of the UAJ e-learning. Additionally, this research aligns with the second study that assesses the usability of e-system applications and provides improvement recommendations for user platform efficiency.

The connection to the third study lies in the reflected similarity of outcomes. Focusing on errors, the heuristic evaluation principles used in that research are also applicable to mitigating potential mistakes in UAJ e-learning. This demonstrates a shared approach in identifying usability issues in different environments. The findings of the article also correspond to the fourth study, where the use of usability principles can impact efficiency, error rate, and user satisfaction in various technological contexts, including e-learning.

Furthermore, the fifth study examining accessibility and usability in e-commerce is relevant to the usability context of this article. Despite the focus on participants with visual disabilities, this connection illustrates the importance of accommodating various user types to ensure good usability. In the context of e-learning, accessibility and usability aspects also play a crucial role in enabling users with diverse abilities and backgrounds to easily access and utilize the system. The

findings of this research indicate that user satisfaction and efficiency levels from a usability perspective in UAJ e-learning are relevant in facing similar challenges.

Parallel to these studies, this article demonstrates that usability evaluation, efficiency enhancement, heuristic guideline implementation, and responsiveness to user feedback are important steps in improving usability and user satisfaction in e-learning platforms. Overall, this article contributes to understanding and enhancing usability in the context of e-learning by incorporating findings from various previous studies that focus on usability and user experience across different platforms and applications.

4. CONCLUSION

Based on the outcomes derived from the evaluation of five distinct usability indicators, it becomes evident that the prevailing sentiment among both students and lecturers leans towards contentment with the e-learning UAJ system. This assertion finds reinforcement in the outcomes of the conducted tests, where a notable portion of lecturers responded neutrally, while a majority of students conveyed positive sentiments in their responses to the survey. Within this context, a set of practical recommendations emerges, meriting contemplation to propel the continual evolution of the e-learning UAJ platform. One of these suggestions revolves around enhancing the learnability aspect. Despite existing favorable feedback regarding learnability, there lies an ongoing potential for refinement to render the system even more accessible and navigable. Achieving this goal may involve the provision of user-friendly guides, interactive tutorials, and precise instructions elucidating the utilization of various system features.

Moreover, the pursuit of improving efficiency persists, even though the system's efficiency has been acknowledged. Advancing the system's performance, responsiveness, and speed stands to foster a more streamlined and effective user experience. Simplifying workflows and curtailing redundant steps further contribute to this overarching goal of enhanced efficiency. Efforts are also directed toward reinforcing memorability. Despite the system being lauded for its ease of recall, endeavors to solidify users' memory of specific functions and attributes persist. The incorporation of visual cues, standardized iconography, and transparent labeling can significantly augment users' ability to recall and locate specific elements within the system.

Furthermore, the imperative of minimizing errors remains, despite reports of a low error rate. Vigilance in this regard involves continuous efforts to mitigate errors and provide instructive error messages when needed. Regular cycles of usability testing and user feedback sessions play a pivotal role in identifying potential areas for improvement, thereby fortifying error prevention and resolution strategies.

Lastly, even though a majority of respondents express satisfaction, the strategic collection of user feedback and the conscientious mitigation of any points of dissatisfaction continue to hold significance. Regular updates, enhancements fueled by user input, and the integration of novel features attuned to user preferences collectively contribute to nurturing an all-encompassing sense of user satisfaction. These recommendations collectively represent a treasure trove of insights, poised to invigorate the usability and user experience intrinsic to the e-learning UAJ framework.

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