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Evaluating the Usability of Moodle-based Learning Management System Application in Faculty of Engineering UNSIKA Using USE Questionnaire

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Abstract: A Moodle-based LMS has been used by the Faculty of Engineering Universitas Singaperbangsa Karawang to support blended learning. Therefore, it needs to be evaluated in terms of user satisfaction and usability. The USE Questionnaire was used in this study to evaluate Moodle-based LMS usability. The usability was evaluated by analyzing the data from the USE Questionnaire, which was personally filled out by 167 respondents, both students and lecturers. The result showed that USE Questionnaire used in this study possessed excellent validity and reliability with coefficient values above 0.700 and 0.981 respectively. In addition, the percentage of each usability parameter for Moodle-based LMS application was as follows: 70,1% of usefulness, 68,9% ease of use, 73,7% ease of learning, and 67,9% of satisfaction. It can be concluded that this application is worthy to use.

Keywords: usability, USE questionnaire, moodle-based LMS application

INTRODUCTION

The application of information systems to manage and make decisions has changed the way organizations provide services to end users (Hardyanto, Purwinarko, and Adhi, 2018). Since the COVID-19 pandemic, the application of information technology for numerous purposes, including learning, has become more common. The subject of online learning is rapidly becoming one of the most discussed topics (Sujito, Arifudin, and Arini, 2019). Online learning allows students to learn more broadly and diversely. Learners can learn whenever and wherever they want using information systems, without limitation of distance, location, or time (Jannah, Sobandi, and Suwatno, 2020). Online learning is distinguished by technological integration and several innovations (Banggur, Situmorang, and Rusmono, 2018). In the field of education, numerous online applications, such as campus websites, laboratory management systems, digital repositories, academic information systems, and others, are employed. Furthermore, online applications, such as the development of e-learning applications, are used in learning systems (Asnawi, 2018). Of course, sufficient learning facilities are essential to the effectiveness of the learning process (Ita, 2023).

The development of e-learning can be accomplished through the use of many platforms or learning management systems (LMS) that are available as open source and can be modified as required. Moodle is one of the open-source LMS technologies used in e-learning development (Yunis and Telaumbanua, 2017) (Choudhury and Khataniar, 2016). Moodle, which stands for "Modular Object-Oriented Dynamic Learning Environment," is a course management system that was developed to assist educators in making online education more efficient (Wahid, 2015). Moodle is easy to develop because it has complete features that can be used for online class management. Moodle's features can help students learn independently, collaboratively, and more effectively. Educators can upload materials that students can access, give tasks, provide quizzes, and create discussion forums to diversify learning activities.

The Faculty of Engineering Universitas Singaperbangsa Karawang has developed and implemented a Moodle-based Learning Management System (LMS) to support blended learning activities. Blended learning is learning that integrates technology into the learning process (Sari, 2021). The development of this application is expected to enhance the effectiveness of the lecturer's implementation of learning, allowing other tasks to be maximized. However, an information system like an LMS application must be tested to guarantee that it can function properly in response to user needs (Jawad Soumik et al., 2019). There are various publications accessible that take a theoretical approach to information system research (Dantas et al., 2017) (Lawson-Body et al., 2017) (Puspitasari et al., 2019) (Purwinarko, Subagja and Yanuarto, 2020). The Usefulness, Satisfaction, and Ease of Use (USE) questionnaire is one of the information system evaluation methods and consists of 30 questions (Gao, Kortum, and Oswald, 2018). The USE questionnaire is advantageous since it does not require any supplementary material and the measurement results are based on user responses. In addition, the USE questionnaires may identify a product's or service's strengths and weaknesses (Purwinarko, Subagja, and Yanuarto, 2020). Therefore, the objective of this research is to conduct an assessment using a USE questionnaire to determine the usability of the Moodle-based LMS application used in the Faculty of Engineering at Universitas Singaperbangsa Karawang.

METHODS

Research Objective

The objective of this research is to evaluate the usability of a Moodle-based LMS application that is currently being utilized at the Faculty of Engineering, Universitas Singaperbangsa Karawang. This application is applied for online learning in both synchronous and asynchronous modes. Currently, this application has about 500 active users consisting of students and lecturers in the Faculty of Engineering.

Research Stages

This research consists of four stages, which are as follows: 1) determination of research objectives, 2) determination of population, research sample, and sampling technique 3) data collection, and 4) data analysis. Figure 1 shows the stages of research in further detail.

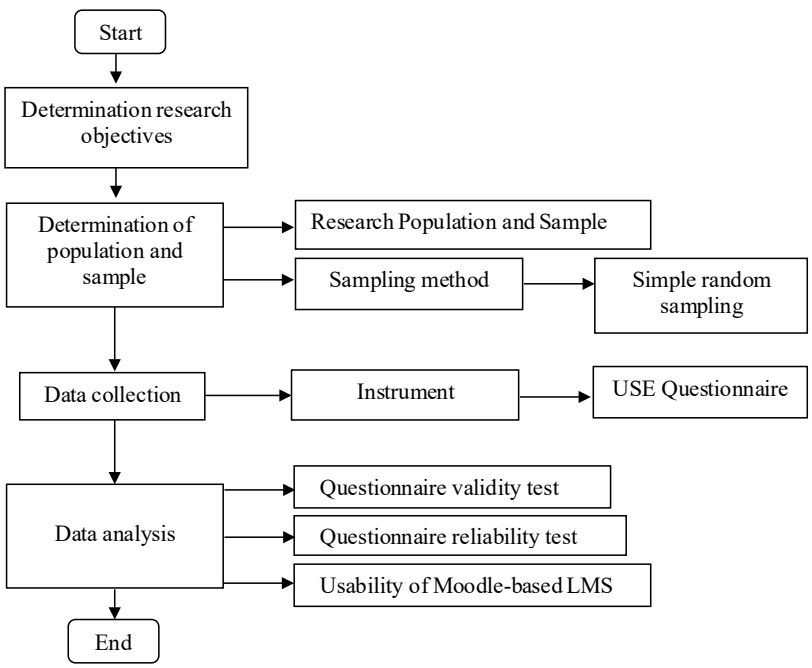

Figure 1. Research Stage

Population and Sampling

The population of this research is active Moodle-based LMS application users, including both lecturers and students. Several samples were taken from the entire population to act as respondents. The size of the sample is determined by applying Yamane's formula, which can be found below.

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

Where n represents the sample number, N represents the population number, and e represents the level of precision. The following is the result obtained when this formula is applied to 500 LMS active users with a confidence level of 90%:

$$n = \frac{N}{1 + N(e)^2} = \frac{500}{1 + 500(0.1)^2} = 83 \quad (1)$$

According to the calculations, the sample size is at least 83 respondents. Simple random sampling was used as the sampling method in the present study. Sampling was done at random, such that strata in the population were neglected. As the smallest population component, each sampling unit has an equal probability of representing that population. As a result, all users are eligible to participate.

Data Collection

Data for this research was collected by delivering surveys to respondents via Google Forms. The USE Questionnaire, which consists of 30 items classified into four categories: usefulness, satisfaction, ease of use, and ease of learning, was employed. The Likert scale, with a range of 1 to 5, is used to assess the respondents' opinions of the Moodle-based LMS application, which is given in Table 1.

Table 1. Rating scales (Likert)

Statement	Score
Strongly agree	5
Agree	4
Neutral	3
Disagree	2
Strongly disagree	1

Each USE Questionnaire statement is given in Table 2. Adjustments were made to the statement items to improve their relevance to the Moodle-based LMS application.

Table 2. USE Questionnaire statement items

No. Item	Statement	No. Item	Statement
Usefulness			
1	It helps me be more effective.	16	I don't notice any inconsistencies as I use it.
2	It helps me be more productive.	17	Both occasional and regular users would like it.
3	It is useful.	18	I can recover from mistakes quickly and easily.
4	It gives me more control over the activities in my life.	19	I can use it successfully every time.
5	It makes the things I want to accomplish easier to get done.	***Ease of Learning***	
		20	I learned to use it quickly.
6	It saves me time when I use it.	21	I easily remember how to use it.
7	It meets my needs.	22	It is easy to learn to use it.
8	It does everything I would expect it to do.	23	I quickly became skillful with it

No. Item	Statement	No. Item	Statement
Ease of Use		***Satisfaction***	
9	It is easy to use.	24	I am satisfied with it.
10	It is simple to use.	25	I would recommend it to a friend.
11	It is user-friendly.	26	It is fun to use.
12	It requires the fewest steps possible to accomplish what I want to do with it.	27	It works the way I want it to work.
13	It is flexible.	28	It is wonderful.
14	Using it is effortless.	29	I feel I need to have it.
15	I can use it without written instructions.	30	It is pleasant to use

Data Analysis

The validity of the data is mainly determined by the quality of the instruments employed. If the instruments possess satisfactory quality concerning validity and reliability, all data obtained will correspond to the facts or actual situations (Yusliani, 2022). Two tests have been performed to evaluate the reliability and validity of the USE Questionnaire to ensure that the acquired data are suitable for further analysis, namely:

Validity Test

The term "validity" relates to the extent to which the data that were obtained correspond to the investigation that was carried out. Validity has been divided into four distinct categories, which are as follows: content validity, criteria validity, construct validity, and face validity (Muijs, 2011). Validation based on construct validity is employed in this study. Construct validity is calculated by showing correlations between a developed measure and other measures that are theoretically related to the construction or varied independently (Oktavia et al., 2018). The Pearson correlation coefficient formula, which is shown below, is used to determine the construct validity of the instruments employed in the study.

$$r_{xy} = \frac{\sum Z_x Z_y}{N}$$

$$rxy = \frac{N\sum XY - \sum X \sum Y}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}} \quad (2)$$

where r_{xy} is Pearson's correlation coefficient, n is the number of valid responses, x is the score of an item, and y is the total score of each respondent with valid responses. It is assumed that both variables (x and y) are normally distributed. Table 3 provides item validity coefficient interpretation criteria.

Table 3. Interpretation of validity coefficients (Saad et al, 1999)

Validity coefficient values	Interpretation
> 0.35	Very advantageous (highly valid)
0.21-0.35	Possibly useful
0.11-0.20	Depends on circumstances
< 0.11	Not likely to be useful

Reliability Test

If measurement validity refers to measurement precision, then instrument reliability refers to the

consistency of the instrument's scores. The most used formula for measuring internal consistency is the Cronbach Alpha coefficient. Cronbach Alpha coefficient is regarded as the most acknowledged measure of reliability when employing the Likert scale. (Taherdoost, 2018). The Cronbach Alpha coefficient is given below.

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k} \sigma_i^2}{\sigma_t^2}\right) \quad (3)$$

where k is the number of statement items, σi^2 is the variance of each statement item and σt^2 is the variance of the overall score (total) on the entire test. The criteria for interpreting an internal consistency reliability coefficient of an instrument are presented in Table 4.

Table 4. Interpretations of internal consistency reliability coefficients (Saad et al, 1999)

Validity coefficient values	Interpretation
> 0.90	Excellent
0.80-0.90	Good
0.70-0.79	Adequate
< 0.70	Less applicable

Validity and reliability tests are calculated using SPSS version 25.0.

Usability Measurement

The usability of a Moodle-based LMS application is calculated using the following formula:

$$Usability\ (\%) = \frac{\%\bar{x}\ Usefulness + \%\bar{x}\ Easy\ of\ Use + \%\bar{x}\ Easy\ of\ Learning + \%\bar{x}\ Satisfaction}{4} \quad (4)$$

The percentage of usability obtained using the formula above was then evaluated using the criteria shown in Table 5.

Table 5. Interpretation of percent usability (Hasan, Zainal, and Suhadjerah, 2020)

Usability (%)	Interpretation
<21	Very Unworthy
21-40	Not Unworthy
41-60	Enough
61-80	Worthy
81-100	Very Worthy

RESULT

Respondents characteristics

The characteristics of the respondents in this study were categorized based on gender and major. The decision to use these characteristics, especially for the major data, is to determine the proportion of each major as a respondent. According to the data in Figure 2, there were 83 male respondents and 84 female respondents. Figure 3 shows that the chemical engineering department had the most respondents (40%) followed by electrical engineering (19%), industrial engineering (10%), mechanical engineering (4%), and environmental engineering (4%).

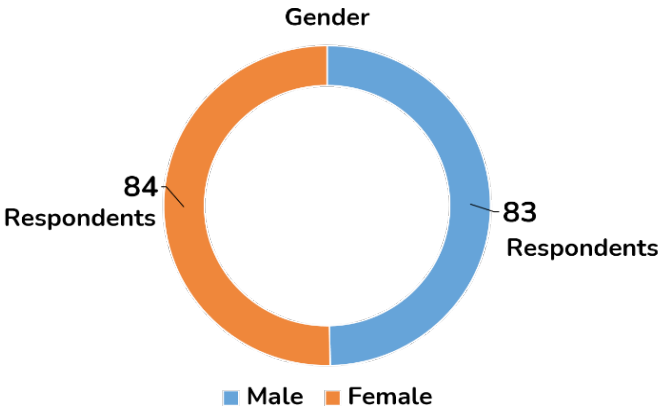

Figure 2. Gender of Respondent

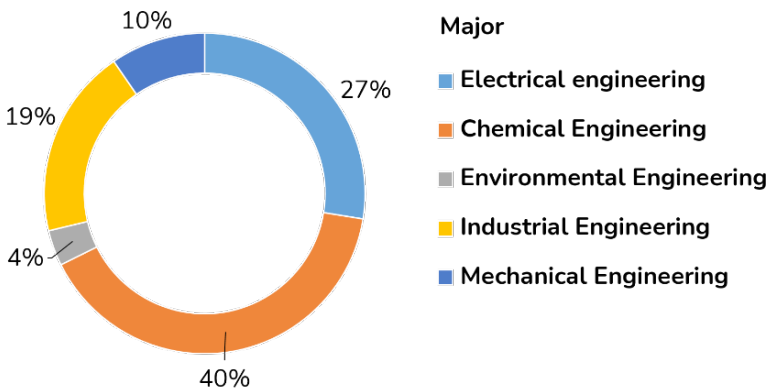

Figure 3. Major of Respondent

Questionnaire Validity Test

The validity test is measured using Pearson's Bivariate Correlations with a confidence level of 95%. The validity test was conducted using data from 167 respondents, hence the r-table is 0.151. It indicates that the measuring instrument is valid if r-count > r-table. If the r-count is less than the r-table, the measuring instruments item is considered invalid. The SPSS validation test results are presented in Table 5. Using the criteria provided in Table 3, Table 5 shows that every statement in the USE Questionnaire has high validity.

Table 6. Instruments Validity Test Result

No. Statement	r_{ecount}	r_{table}	Conclusion	Validity category
1	0.794	0.151	Valid	Highly valid
2	0.814	0.151	Valid	Highly valid
3	0.813	0.151	Valid	Highly valid
4	0.844	0.151	Valid	Highly valid
5	0.791	0.151	Valid	Highly valid
6	0.752	0.151	Valid	Highly valid
7	0.821	0.151	Valid	Highly valid
8	0.806	0.151	Valid	Highly valid

No. Statement	r_{ecount}	r_{table}	Conclusion	Validity category
9	0.843	0.151	Valid	Highly valid
10	0.807	0.151	Valid	Highly valid
11	0.808	0.151	Valid	Highly valid
12	0.798	0.151	Valid	Highly valid
13	0.840	0.151	Valid	Highly valid
14	0.861	0.151	Valid	Highly valid
15	0.723	0.151	Valid	Highly valid
16	0.760	0.151	Valid	Highly valid
17	0.825	0.151	Valid	Highly valid
18	0.749	0.151	Valid	Highly valid
19	0.675	0.151	Valid	Highly valid
20	0.784	0.151	Valid	Highly valid
21	0.765	0.151	Valid	Highly valid
22	0.831	0.151	Valid	Highly valid
23	0.822	0.151	Valid	Highly valid
24	0.826	0.151	Valid	Highly valid
25	0.818	0.151	Valid	Highly valid
26	0.886	0.151	Valid	Highly valid
27	0.770	0.151	Valid	Highly valid
28	0.809	0.151	Valid	Highly valid
29	0.817	0.151	Valid	Highly valid
30	0.877	0.151	Valid	Highly valid

Questionnaire Reliability Test

The Cronbach Alpha coefficient was used in the reliability test, which had a 5% level of significance. This test was performed using all of the answers for all valid statements. The SPSS reliability test results are shown in Table 6.

Table 7. Instrument Reliability Test Result

Cronbach's Alpha coefficient	N of Item	Category
0.981	30	Excellent

The Cronbach Alpha coefficient of the USE Questionnaire was found as 0.981 for internal consistency reliability. According to the interpretation of the criteria for the instrument's internal consistency reliability shown in Table 4, these results show that the instrument has an excellent level of internal consistency reliability.

Usability of Moodle-based LMS Application

The four aspects of the USE questionnaire (usefulness, ease of use, ease of learning, and satisfaction) are used to assess the usability of Moodle-based LMS applications. These four parameters have statement items in Table 2, and a Likert scale was used to determine how each respondent measures the Moodle-based LMS applications that they already use. Figure 4 shows the percentage of each usability parameter's result from the Moodle-based LMS application.

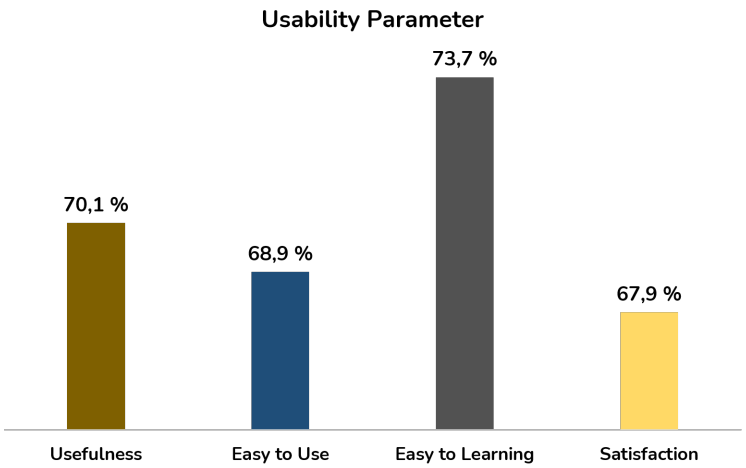

Figure 4. Comparison of usability Parameter Percentage

The results are obtained by dividing the average of each parameter by the maximum possible score on the assessment instrument and multiplying by 100%. The parameters for ease of learning score highest, at 73.7%. Then, 70.1 percent of respondents found the usefulness of Moodle-based LMS applications, 68.1 percent found it easy to use, and 67.1 percent were satisfied with it.

Usefulness Parameter

As shown in Table 2, the usefulness parameter has eight statements that were asked of the respondents in this study. To do parameter analysis, the mean score for each statement on the usefulness parameter is determined. The mean score is shown in Figure 5.

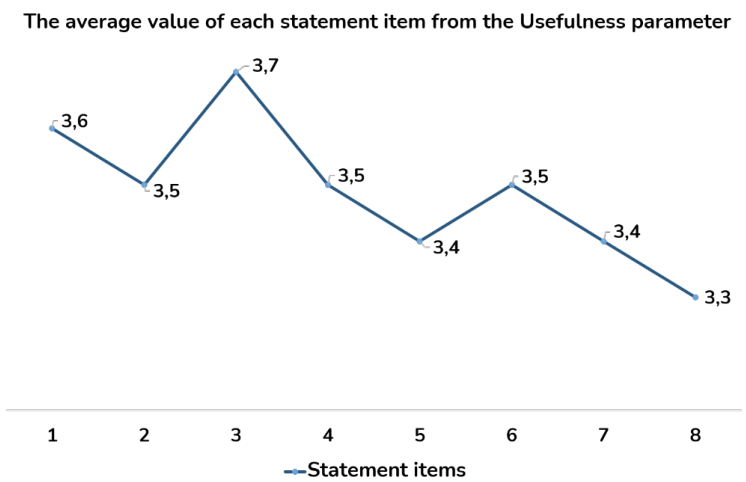

Figure 5. The Average Value of Each Statement Item from the Usefulness Parameter

Ease of use parameter

The ease of use parameter includes 11 different statement items that have been put to assessment by the respondents in this study. Each of the statement items is valid. For parameter analysis, the mean score of each statement on the ease-of-use parameter is obtained. The result of the mean score of each statement item is shown in Figure 6.

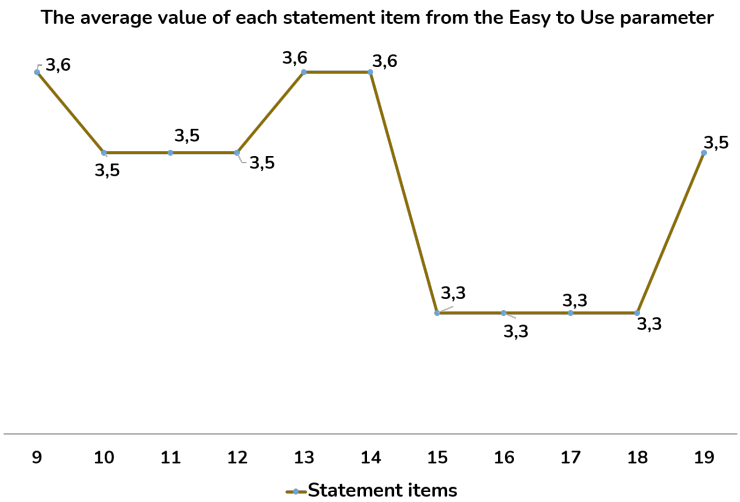

Figure 6. The Average Value of Each Statement Item from the Ease of Use Parameter

Ease of learning parameter

The ease of learning parameter consists of 4 statement items. A validity test found that all of the statement items in this parameter were valid. Identical to the previous two parameters, the mean score of each statement on the ease of learning parameter is calculated for parameter analysis. Figure 7 shows the result of calculating the mean score for each statement item for the ease of learning parameter.

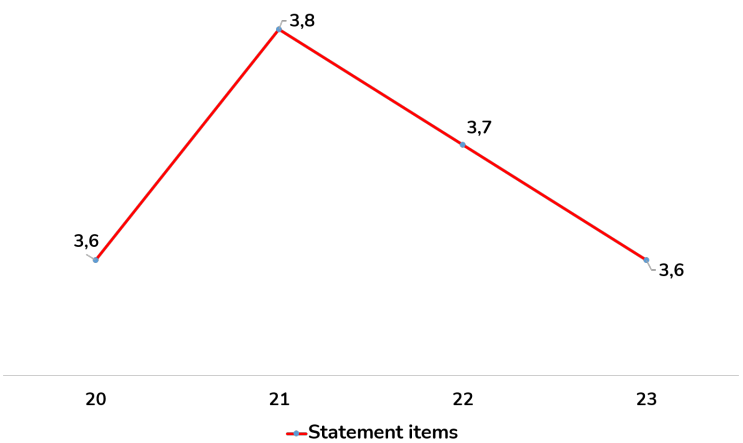

Figure 7. The Average Value of Each Statement Item from the Easy-of-Learning Parameter

Satisfaction

The satisfaction parameter has 7 statement items that have been assessed by the respondents. All of the statement items have a high level of validity. For parameter analysis, the mean score of each statement on the satisfaction parameter is calculated. The result of calculating the mean score for each statement item in the satisfaction parameter is presented in Figure 8.

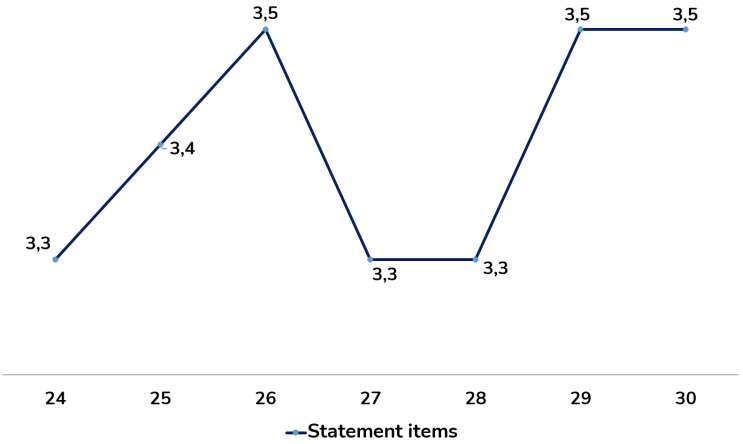

Figure 8. The Average Value of Each Statement Item from the Satisfaction Parameter

Measurement usability of Moodle-based LMS application

The level of usability of the Moodle-based LMS application can be measured using the formula for usability measurement. The average score of each USE Questionnaire parameter was summed up, divided into four, and then multiplied by 100% until the usability measurement result is obtained. The usability score will then be converted based on the criteria shown in Table 5.

Table 8. Result of Usability Measurement of Moodle-Based LMS Application

Usability Measurement Result	Usability (%)	Interpretation
70,2%	61 - 80	Worthy

DISCUSSION

The validity and reliability of the research instruments considerably influence the quality of the data collected, which in turn influences the analysis and research conclusions. The USE Questionnaire as the instrument used in this study has excellent validity and reliability as shown in Tables 6 and 7. It is feasible to conclude that the USE Questionnaire possesses the ability to collect data corresponding to the actual investigation area. This implies the data collected by the USE Questionnaire is eligible for further calculation and analysis to get information and research results.

Afterward, regarding data on respondent characteristics, the lack of a substantial gender gap in the number of respondents shows that both males and females are capable of using Moodle-based LMS. In conjunction with this, the majority of the respondents are students who grew up with computers, gadgets, and the Internet. This contributes to the process of learning to use the application faster and easier.

Meanwhile, while addressing the usability of Moodle-based LMS, the usefulness parameter has an average score of 3,5, or 70,1%. These results suggest that respondents perceive Moodle-based LMS applications as quite useful. These near-neutral values may be due to respondents' continuous use of other digital platforms, and they do not fully implement learning activities using a Moodle-based LMS application. The lowest statement item is obtained on the eighth item, which states, "It does everything I would expect it to do". The low score of the eighth item's statement suggests that the available features do not match all of the needs of the learning process. Consequently, the functionality of the features has to be improved.

The average number for the ease-to-use parameter is 3.4, or 68,9%, which is close to a neutral score. These results indicate that respondents determine Moodle-based LMS applications to be fairly easy to use. Considering that the majority of users are digital natives, the average score for ease of use parameters

of that size is quite low. One of the statements with the lowest score is on item number 15, which states, "I can use it without written instructions". This indicates that respondents still require guidance, like a module or video tutorial, for using the Moodle-based LMS application. The next statement item with a low average score is statement item number 16, which states, "I do not observe any inconsistencies as I use it". This indicates that there is still inconsistency in some parts of the Moodle-based LMS system based on the assessment of respondents. Therefore, it is necessary to have a thorough evaluation of the system, from the features to the user interface of the Moodle-based LMS application.

The average score for the ease of learning parameter is 3.7 or 73,7%, which is larger than the previous two parameters. These results indicate that respondents consider Moodle-based LMS applications to be quite easy to learn. It is easy to learn a Moodle-based LMS application because the majority of respondents are digital natives. However, item numbers 20 and 23 indicate the lowest value, which relates to the analysis of the results of the previous parameters, indicating that respondents still need guidance in using Moodle-based LMS applications.

The average number for the satisfaction parameter is 3.4 or 67,9%, the same as the average number for the ease of use parameter. Respondents who have used Moodle-based LMS applications reported relatively low levels of satisfaction. This is related to some results of the analysis of the previous parameters that still need to be improved in some ways by the Moodle-based LMS application so that they affect the satisfaction parameters. As shown in Table 8, the measurement results for the usability of a Moodle-based LMS application are shown with the interpretation "worthy". This means that the Moodle-based LMS application has good usability but still needs to be improved in some ways.

CONCLUSIONS AND SUGGESTIONS

Conclusion

A Moodle-based LMS application has been developed and implemented by the Faculty of Engineering UNSIKA to support learning activities. The degree of usability of the Moodle-based LMS application was assessed in this study using the USE Questionnaire, which had been distributed to 167 respondents. Respondent characteristics were categorized based on gender and major. Respondents were 83 men and 84 women, with 40% majoring in chemical engineering, 27% majoring in electrical engineering, 19% majoring in industrial engineering, 10% majoring in mechanical engineering, and 4% majoring in environmental engineering. A validity and reliability test on the questionnaire was conducted before to further analysis of the usability of the Moodle-based LMS application. The result shows that all of the statement items are valid based on a validity test with strongly valid criteria. The result of the reliability test using the Cronbach alpha of the USE Questionnaire is 0.981. This result confirms that the instrument's internal consistency reliability is excellent.

The level of usability of the Moodle-based LMS application was analyzed based on four parameters of the USE Questionnaire showing 70.1% for the usefulness parameter, 68.9% for the easy-to-use parameter, 73.7% for the easy-to-learning parameter, and 67.9% for the satisfaction parameter. These results show that the Moodle-based LMS application is suitable for use. The usability test results for the Moodle-based LMS application were classified as "worthy," with a value of 70.2%.

Suggestion

The following suggestion was proposed to improve the usability of Moodle-based LMS in this study: 1) To improve usefulness and user satisfaction, it is necessary to enhance the features that are currently provided by the Moodle-based LMS Application by taking into consideration the preferences of the users and 2) To encourage user ease of learning and ease of use, it is important to create user guides for students and lecturers that are packaged in a simple and appealing format.

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