JURNAL INFOTEL
Informatics - Telecommunication - Electronics

Website Jurnal : http://ejournal.st3telkom.ac.id/index.php/infotel
ISSN : 2085-3688; e-ISSN : 2460-0997

Usability and user satisfaction rate evaluation on e-learning application from student's perspective using Nielsen usability method

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Received 06 June 2021, Revised 02 August 2021, Accepted 20 August 2021

Abstract — Covid-19 is a new and contagious disease that has spread throughout the world community. This disease has spread to Indonesia since early March 2020. One way to prevent the spread of this virus is by implementing activities from home. Budi Luhur University is one of the educational institutions that has implemented work and learning from home during the Covid-19 pandemic. The E-Learning application is the main tool used both from the faculty and student sides in the teaching and learning process. However, the total and urgent implementation of the E-Learning application, which began in March 2020, caused several problems that reduced students' comfort in carrying out the learning process. This study aims to measure the level of student satisfaction and the level of use of the E-Learning application and its features. This study used a survey sampling method by distributing questionnaires and getting results from 115 respondents. The method used in this research is the Nielsen Usability method. Measurements were made using five criteria: Learnability, Memorability, Efficiency, Errors, and Satisfaction. The result show, although the average of each dimension is in the satisfying interpretation, there are significant differences in the level of satisfaction in each dimension. The dimension with the lowest average rating is the Errors dimension. It shows that respondents still find some errors when using the E-Learning application. Therefore, the respondents do not show significant satisfaction in terms of the Errors dimension. On the other side, the result shows that the respondent thinks face-to-face meetings are still needed.

Keywords – E-Learning, student, usability, satisfaction

I. INTRODUCTION

Covid-19 is a new disease that has attacked all countries in the world starting in December 2019. This disease causes respiratory tract infections in humans ranging from cold coughs to life-threatening human beings. The spread of this disease occurs through droplets from the nose or mouth that come out of a person infected with Covid-19, coughing, or exhaling [1]. Until now, there are no definite vaccines or drugs to treat this disease.

In Indonesia, the first finding of people with Covid-19 was on March 2, 2020. Based on reports from the government, the increase in the number of sufferers continues to increase every day [2]. Since mid-March 2020, many companies and educational institutions have started to think about changing the status of how to work and how to learn to work from home by relying on information technology devices and applications. Budi Luhur University (UBL) has become one of the campuses that officially holds lectures and works from home since March 16, 2020 [3]. For the teaching and learning process, lecturers and students rely on the E-Learning application as the main tool used and other support applications.

The E-Learning application at Budi Luhur University has been actively running for the past year, marked by the obligation of lecturers and students to carry out online lectures in each course in several meetings in one semester. However, during the Covid-19 pandemic, the teaching and learning system had to be carried out in their respective homes. As a result, online lectures became an obligation that had to be

carried out by lecturers and students. This sudden change caused by the Covid-19 pandemic gave rise to turmoil in E-Learning applications, especially on the side of Budi Luhur University students. The E-Learning application was carried out simultaneously in mid-March 2020 in line with the implementation of government regulations for activities from home. This concurrent use raises several problems. The problem that arises from the user's side is that errors or failures are found in accessing, downloading, or uploading files during the peak time of lectures between 08.00 - 17.00. In addition, there are problems from the student's point of view in terms of the inconvenience of using an E-Learning application, for example, the absence of notification of lecture implementation and the number of files that must be accessed when carrying out a lecture.

Pebriantika et al., in their research, found that mobile learning is the learning that students are most interested in because it can be accessed through their cell phones. They found a significant effect between the adoption of mobile learning on students' interest in learning during the covid 19 pandemic [4]. In another study, Biswas et al. measure the student's perception of using mobile for learning during COVID-19 in Bangladesh. They examine whether mobile learning can help the students to fulfill the study gap. This study revealed that m-learning is very helpful to recover the study gap during this COVID-19 pandemic time [5]. In other research, Alghazi et al., in their research, investigated the necessary factors influencing the intention to use mobile learning among college students. The results indicated that devices connectivity, device compatibility, device memory, device performance, network coverage, and network speed have a significant and positive influence on student's intention to use mobile learning [6]. The review results presented by Hussain et al. stated that factors must be considered while using mobile educational apps to improve students' academic self-efficacy. The review shows that the two most important factors necessary for improving students' academic self-efficacy using mobile educational apps are teachers' messages and the success and failure of others [7]. Therefore, this research will discuss how the level of acceptance of UBL students towards E-Learning application and the features in it based on existing dimensions. Then the acceptance rate value of the E-Learning application will be obtained as the main tool in the teaching and learning process during the Covid-19 pandemic.

With the use of technology in educational systems, ways of accessing information have changed, and such concepts as mobile learning have emerged. In recent years, mobile learning (M-learning) has been an important component of distance education. [8]. Therefore, it is necessary to analyze the level of usability and accessibility of Mobile learning apps. Several research results analyze the level of usability and accessibility of academic websites or M-Learning apps. The usability evaluation by involving the user respondents has an advantage on information about how the users use the system as well as problems faced directly by them [9]. In measuring the level of usability, we can use a questionnaire-based evaluation technique, and the second is a performance-based evaluation [10].

Several previous studies have investigated the usability effectiveness of mobile learning apps. A questionnaire distributed online to students from various universities in India concluded that mobile learning applications could be very useful in higher education environments [11]. Another study concluded that students appreciated mobile learning as an approach that may significantly increase their motivation [12]. The research results conducted by Xue et al. comparing learning in traditional classrooms with mobile learning show that mobile learning can produce similar learning results as traditional classroom instruction. However, students had mixed attitudes towards different aspects of mobile learning. [13]. Gome-Ramirez et al. show that the adoption of mobile technologies has generated a university transformation and has affected processes and operations and organizational structures by presenting new management concepts. Therefore an approach is needed to increase M-learning acceptance among students [14]. Khan et al., in their research results, show that students in higher education have diverse preferences for using mobile devices in their learning that involves both fragmented and cohesive aspects of learning [15].

The way used to measure the level of student satisfaction using E-Learning application in this research is by using the questionnaire method. The survey, which was conducted by distributing questionnaires, was formed using the Nielsen method. This method is used to describe the level of acceptance of an application using the user's perspective. The results obtained will be processed to measure the level of acceptance by the student of the E-Learning application. The Nielsen method measures the use of the E-Learning application based on 5 dimensions, namely Learnability, Memorability, Efficiency, Errors, and Satisfaction.

From this research, that input will be obtained to determine students' expectations of the E-Learning application applied at the campus. In the end, it can improve services to students, especially in terms of the application of online teaching and learning.

II. RESEARCH METHODS

According to Nielsen, usability is a quality attribute that describes or measures how easy it is to use an interface. Therefore, usability is an important factor in developing an application. In modeling, Nielsen describes a scheme of successful acceptance of a system by users. The system's acceptance is influenced by several factors that are the root of its success described below [16].

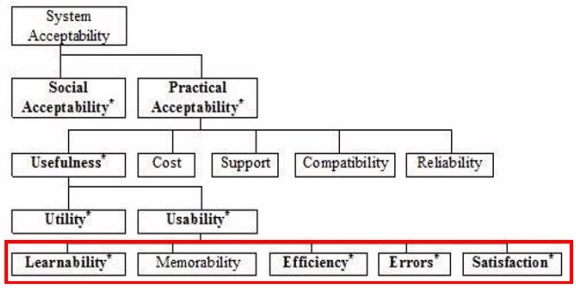

Fig.1. Usability Nielsen Model

According to Nielsen, usability can be measured by five criteria, namely:

1. Learnability, which measures the level of ease of doing simple tasks when the first encounter a design. This factor has indicators or criteria that can indicate that an application has met the learnability factor as one of the success factors of usability factor performance. These indicators are:
   - Easy to understand, namely the application can be understood how to use it and understand the purpose or information that can be obtained in the application easily.
   - Easy to look for specific information. Users can easily obtain information or insights from those presented by the application features, and the information obtained is useful for users.
   - Easy to identify the navigational mechanism. That is, the user can identify the navigation mechanism of each application's features easily.

   As an easy-to-learn application, there is a criterion that the system can present an interface that allows users to assist their knowledge without extra effort in using the application. In addition, it allows users to build knowledge about the interaction patterns they have learned through the use of existing applications.

2. Efficiency is measuring the speed of doing a certain task after studying the design. This factor has indicators or criteria that can indicate that an application has met the efficiency factor as one of the factors for the success of the usability factor performance. These indicators are:
   - Easy to reach quickly, users can get information, get to the features they need, and complete tasks quickly.
   - Easy to navigate, where users can navigate themselves or their knowledge of the use of the application by easily browsing the features and content available on the application.

   Some of the criteria for determining the achievement of efficiency indicators are measuring the number of steps performed in performing a task and the time spent working on a given task. In addition, by measuring the average time, it takes to perform a task and navigate the menu in seconds.

3. Memorability is to see how quickly the user regains proficiency in using the design when he returns after some time. This factor has indicators or criteria that can indicate that an application has met the memorability factor as one of the success factors of the usability factor performance. These indicators are:
   - Easy to remember, which is how users can easily remember its use in exploring every feature and content contained in the application.
   - Easy to reestablish, which is where the application can be easily accessed for reuse by the user, accompanied by an access process for using the same application as when the user had previously accessed it.

4. Few Error detections are to see how many mistakes the user made, how bad the errors were made, and how easy they were to get a resolution. This factor has indicators or criteria that can indicate that an application has met the error detection factor as one of the factors for the success of the usability factor performance. These indicators are:
   - Few error detections are detected, which is the discovery of a few errors detected in the application when used by the user, and errors made by the user using the application are also detected minor.
   - Easy to fix, where the detected error detection can be corrected easily.

5. User's satisfaction measures the level of satisfaction in using the design. This factor has indicators or criteria that can indicate that an application has met the error detection factor as one of the factors for the success of the usability factor performance. These indicators are:
   - The system is pleasant to use, which is where the application can give a pleasant impression to be used by the user.
   - Comfort to use is where users feel comfortable when using the application without being burdened by certain terms and conditions that make it difficult to access the application.

It is necessary to collect precise and accurate data to obtain maximum results in this research. The technique used is a survey method. The target

population of this study was active Budi Luhur University students. During 2019/2020 even semester, they used the E-Learning application as the main tool for teaching and learning. In addition, these students also used the E-Learning application in the previous semester, namely the Odd semester 2019/2020. The number of targets required is between 100-120 people. The data collected using the method above is expected to be sufficient to be used as input data to be analyzed at a later stage.

The questionnaire is designed to be completed in less than 15 minutes. Each statement in the questionnaire is arranged in a neutral form of words. The questionnaire is designed to collect information from the following three things:

1. Collect profile information from respondents
2. Collecting information that aims to investigate student habits in using E-Learning applications
3. Collecting information to get students' perceptions of the E-Learning application.

The data analysis method used in this study was the SPSS application. From the results of the first data processing, information about the general description of the respondents will be obtained. Then, each respondent was given questions according to the Nielsen method to measure the level of satisfaction using E-Learning based on students' habits in using E-Learning. In addition, information about how far students want to use the E-Learning application will be collected and processed. From this research, input was obtained to determine students' expectations of E-Learning applications on campus. In the end, it could improve students, especially in implementing online teaching and learning.

III. RESULTS

The object of this research is the content of the E-Learning application presented to Budi Luhur University students during lectures during the Covid-19 pandemic. Tests are carried out to get the level of student satisfaction with the E-Learning application in terms of ease of learning the application (Learnability), ease of remembering navigation in the application (Memorability), efficiency in application use (Efficiency), the number of errors found during application use (Errors), and in the end measure student satisfaction in using E-Learning in terms of application and content (Satisfaction).

A. Respondent Demographics

The sample of students used was 115 people. The number of male respondents was 89% (102 people), and female respondents were 11% (13 people) as shown in Fig. 2.

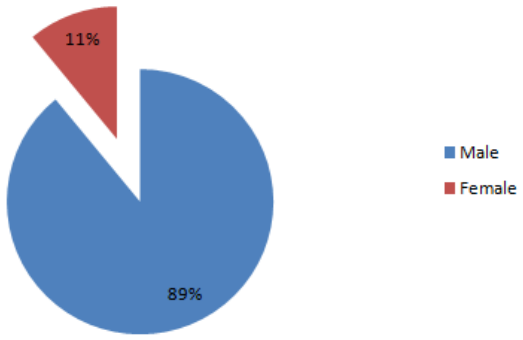

Fig. 2. Demographics of Respondents

From the 115 respondents, there were 6 age groups who participated in this research questionnaire. Based on the chart below, the 20-year-old group dominates with 43 respondents, followed by the 19-year-old group with 37 respondents. Furthermore, there are 15 respondents in the 21-year-old group, 7 in the 22-year-old group, 4 in the age group over 22 years old, and 1 respondent in the under-19 age group. Meanwhile, there were 8 respondents who decided not to answer age. The demographic graph of the respondents' gender is shown in Fig. 3.

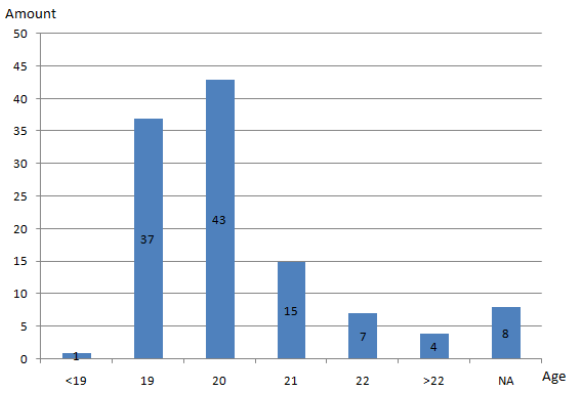

Fig. 3. Respondent Age Group Demographics

In the odd semester of 2019/2020, the E-Learning application began to be optionally applied to students. This research itself took place during the even semester of 2019/2020. Therefore, a mapping was also carried out whether the respondent. It had been active in the application in the odd semester of 2019/2020. The activity in question is that students have done at least one of the following activities: filling in attendance or attendance, downloading materials, using forums or chat, or submitting assignments through the E-Learning application. From the questionnaire results obtained and shown in Figure 4.3, 97% of respondents (111 people) have at least had minimal activities in the E-Learning application, and 3% of respondents (4 people) have never used the E-Learning application.

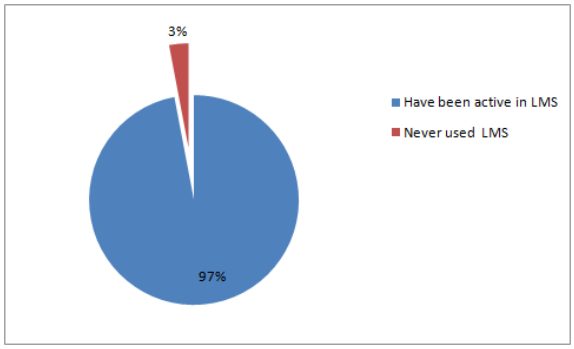

Fig. 4. Demographics of Respondents' Activities in E-Learning

B. *Test Result*

The process of filling out the questionnaire is done online. After getting a sufficient number of respondents, all data obtained were recapitulated using Ms. Excel. Furthermore, conclusions are drawn based on the data from the recapitulation results.

The questionnaire consisted of 18 core questions based on the NAU Method (Nielsen's Attributes of Usability). The list of statements in the questionnaire from the NAU method is divided into 5 criteria: Learnability, Memorability, Efficiency, Errors, and Satisfaction.

Table 1. List of questionnaire statements

No	Code	Statement
		Learnability
1.	L1	I can learn the Learning Management System (LMS) web of Budi Luhur University easily
2.	L2	I can learn the LMS web navigation flow easily
3.	L3	I can learn the use of the LMS web without written instructions
4.	L4	I get specific information on the LMS web easily
5.	L5	I understand the content of the information presented easily
		Memorability
6.	M6	I remember how to use the LMS web easily
7.	M7	I memorize each navigation direction to easily navigate features and content
8.	M8	I remember how to use the LMS web if I use it again after a while (> 1 month)
		Efficiency
9.	EF9	I can quickly access the menus and features on the LMS web
10.	EF10	I can quickly get the information I am looking for
11.	EF11	I can complete test tasks quickly (upload assignments and files)
		Errors
12.	ER12	I encountered an error or bug when using the web LMS
13.	ER13	I found that there is a menu on the UBL LMS web that doesn't work according to its function
14.	ER14	I couldn't find the menu I wanted to find
		Satisfaction
15.	S15	I feel overall happy with the look of the LMS web design
16.	S16	I feel comfortable using the LMS web
17.	S17	The color composition and placement of the content didn't confuse me
18.	S18	The use of the LMS web is in accordance with the expectations of the business I do

Furthermore, the respondent's assessment of the level of satisfaction in utilizing the Learning Management System service is designed using a Likert scale. For the criteria of Learnability, Memorability, Efficiency, and Satisfaction, there is 5 assessment components on the questionnaire with the following interpretation of values, namely: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), and Strongly Disagree (1). Meanwhile, the Errors criterion has the following interpretation of values, namely: Strongly Agree (1), Agree (2), Neutral (3), Disagree (4), and Strongly Disagree (5). Before starting the questionnaire, respondents are advised to avoid Neutral answers to obtain a more objective assessment. After obtaining the average rating of each criterion, the assessment results will be interpreted based on the assessment interval, as shown in Table 2.

Table 2. Interval rate

Rate	Code	Interval
Strongly Agree	SA	>4
Agree	A	<4
Neutral	N	<3
Disagree	D	<2
Strongly Disagree	SD	<1

Table 3 below is a conversion value from the answer choices in the questionnaire into an interpretation of the assessment.

Table 3. Interpretation of assesment

Rate	Interpretation
Strongly Agree	Very Satisfied
Agree	Satisfied
Neutral	Neutral
Disagree	Not Satisfied
Strongly Disagree	Very Dissatisfied

Following are the results of the calculation of respondent satisfaction with a total of 115 people on implementing the Learning Management System with a Likert scale shown in Table 4.

Table 4. The results of the questionnaire assessment

Code	SA	A	N	D	SD	Rate	Interpretation
L1	4	14	41	50	6	3.347826087	Agree
L2	0	7	45	59	4	3.52173913	Agree
L3	3	13	38	55	6	3.417391304	Agree
L4	1	27	40	44	3	3.182608696	Agree
L5	6	20	41	43	5	3.182608696	Agree
M6	0	3	23	80	9	3.826086957	Agree
M7	0	16	26	65	8	3.565217391	Agree
M8	1	4	29	78	3	3.67826087	Agree
EF9	1	6	35	68	5	3.608696	Agree
EF10	3	15	45	47	5	3.313043	Agree
EF11	2	11	36	60	6	3.495652	Agree
ER12	0	23	38	36	18	2.573913	Neutral
ER13	2	48	35	24	6	3.13913	Agree
ER14	4	50	41	19	1	3.321739	Agree
S15	0	15	49	45	6	3.365217	Agree
S16	1	11	49	49	5	3.4	Agree
S17	3	16	33	55	8	3.426087	Agree
S18	1	8	54	50	2	3.382609	Agree

For the average assessment of each component of the assessed statement, the ER12 assessment component received the lowest average rating with a value of 2.57391. It is related to the statement, "I encountered an error or bug when using the UBL LMS web". Meanwhile, the highest-scoring component was M6, with an average rating of 3.826086957. It is related to the statement, "I remember how to use the LMS UBL web easily". From 18 assessment components, 17 assessment components scored with Agree interpretation, while 1 assessment component scored with Neutral interpretation. The component that gets a Neutral rating is a statement from the Errors dimension, namely: I encountered an error or bug when using the UBL LMS web. Figure 5 is a diagram showing the average rating of each criterion.

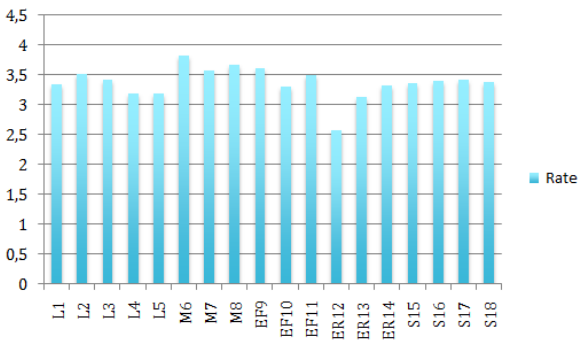

Fig. 1. Value chart for each criterion

Meanwhile, for the average assessment of each dimension, it can be seen in Table 5 below.

Table 5. Rate Per Dimension

Dimension	Average	Interpretation
Learnability	3.330435	Agree
Memorability	3.689855	Agree
Efficiency	3.472464	Agree
Errors	3.011594	Agree
Satisfaction	3.393478	Agree

The overall average assessment of the 5 dimensions gets an agreeable interpretation from the respondent, where the value range is between 3.0 - 3.6. From the results above, a Radar Chart can be made for each dimension as shown in Fig. 6.

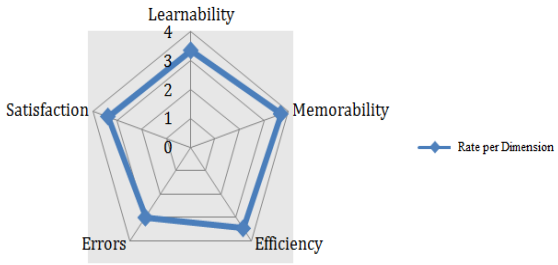

Fig. 2. Radar chart value dimensions

Although the average of each dimension is in the satisfying interpretation, there are significant differences in the level of satisfaction in each dimension. For example, the Memorability dimension is the dimension that gets the highest average rating. It means that respondents considered it easy to explore every feature and content contained in the E-Learning application. In addition, respondents

considered that using the application was easy to remember after returning some time later. On the other hand, for the dimensions of Learnability, Efficiency, and Satisfaction, they get an average rating close to between 3.3 - 3.4. It shows that respondents are satisfied with the application in terms of easy-to-understand use (Learnability), the application is efficient in performing certain tasks (Efficiency), and respondents are generally satisfied in using the E-Learning application and feel comfortable using it (Satisfaction). However, in the Learnability dimension, there are components below the E-Learning application's average dimensions, namely the L4 and L5 components, which are related to the ease of finding and reading the information presented.

The dimension with the lowest average rating is the Errors dimension, with a value of 3.01. Even though it is still in the satisfying interpretation, there are several assessment components in the Errors dimension in the Neutral assessment. It shows that respondents still find some errors when using the E-Learning application. Therefore, the respondents do not show significant satisfaction in terms of the Errors dimension.

At the end of the questionnaire, respondents were asked questions about the ideal use of LMS as the main tool in the teaching and learning process when the Covid-19 pandemic ended. Table 6 below shows the respondent's desire to use LMS when the Covid-19 pandemic has ended.

Table 6. Acceptance of Respondents to LMS Based on Conditions

Using LMS (Learning Management System)/face-to-face lectures Condition	The number of respondents who agreed	%
100% of lectures must be conducted face-to-face	10	8.7
100% of lectures can be carried out online	1	0.8
75% (between 11-12 of 15 meetings) courses can be conducted online	11	9.5
50% (between 7-8 of 15 meetings) courses can be conducted online	43	37.4
25% (between 3-4 out of 15 meetings) lectures can be conducted online	50	43.5

From the table above, it can be seen that most respondents (80.9%) want the composition of using LMS as the main tool in lectures to be 25% and 50% of the total lectures in one course per semester. It may imply that the respondent thinks face-to-face meetings are still wanted and needed. However, it shows that the E-Learning application's full use as the teaching and learning tool has not satisfied the respondents' desires compared to face-to-face meetings on campus.

IV. DISCUSSION

Students agree that the E-Learning application can help in terms of ease of learning the application (Learnability), ease of remembering to use (Memorability), conciseness in application use (Efficiency), the number of errors that occur during use (Errors), and general satisfaction in using the application (Satisfaction). However, the value of each dimension varies and needs attention. The dimension with the lowest average rating is the Errors dimension. Even though it is still in the satisfying interpretation, there are several assessment components in the Errors dimension in the Neutral assessment. It shows that respondents still find some errors when using the E-Learning application. Therefore, the respondents do not show significant satisfaction in terms of the Errors dimension. It answers the question that there are some error problems when using the E-Learning application in 2019/2020 even semester. The Memorability dimension is the dimension that gets the highest average rating. Respondents considered it easy to explore every feature and content contained in the E-Learning application. About 80% of respondents want online lectures to use E-Learning at a maximum of 50 % of the total meeting. It shows that students still want the lecture meeting to be held face-to-face with a maximum of 50%.

Further research was carried out on the dimensions of Errors for shows whether there is a better chance of the error rate generated by the E-Learning application during the teaching and learning process.

V. CONCLUSION

This study measures the level of student satisfaction and the level of use of the E-Learning application and its features. This study uses a survey sampling method by distributing questionnaires and getting results from 115 respondents. The method used in this research is the Nielsen Usability method. The result showed E-Learning applications can help in terms of ease of learning the application (Learnability), ease of remembering to use (Memorability), conciseness in application use (Efficiency), the number of errors that occur during use (Errors), and general satisfaction in using the application (Satisfaction). However, in the Learnability dimension, there are components below the E-Learning application's average dimensions.

Furthermore, the dimension with the lowest average rating is the Errors dimension with a value of 3.01. Thus, even though it is still in the satisfying interpretation, there are several assessment components in the Errors dimension in the Neutral assessment. It shows that respondents still find some errors when using the E-Learning application.

Therefore, the respondents do not show significant satisfaction in terms of the Errors dimension.

At the end of the questionnaire, respondents were asked questions about the ideal use of LMS as the main tool in the teaching and learning process when the Covid-19 pandemic ended. The result showed that most respondents (80.9%) want the composition of LMS as the main tool in lectures in 25% - 50% of the total lectures in one course per semester. It may imply that the respondent thinks face-to-face meetings are still wanted and needed.

ACKNOWLEDGMENT

This research is supported by a research grant under the Directorate of Research and Community Service from Budi Luhur University with Reg. No. 01601LPJ1120.

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