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Usability Test on a Learning Website by Using the Eye Tracking Method

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***Abstract*: The usability of a learning website is necessity to ensure its effectiveness and efficiency. The study aims to discover the usability test results and find out how to propose the improvements of a learning website. The usability evaluation was carried out by employing the Eye Tracking method, a technique that allows academics or researchers to analyze the visual aspect, including users' search, usage duration, and the searching order. The test is performed by providing several tasks to the respondent, then recording the processing time. The results revealed that the level of effectiveness' calculation in Task 1 obtained a percentage of 88.57%, 41.63% in Task 2 and 48.57% in Task 3. Moreover, the efficiency level calculation shows that, TBE in Task 1 = 0.038 goals/sec, TBE in Task 2 = 0.024 goals/sec, TBE in Task 3 = 0.031 goals/sec. Then, ORE in Task 1 = 85.99%, ORE in Task 2 = 29.83%, ORE in Task 3 = 34.44 %. Hence, it was illustrated that the website should be improved on the area of interests.**

***Keywords*: E-Learning, Usability, Effectiveness, Efficiency, Eye tracking.**

1. Introduction

The existence of information technology (IT) is currently developing so rapidly and penetrated various sides of human existence. IT had a major influence on various aspects of society, education in particular. In term of education, the use of IT can be used as an electronic learning medium known as E-Learning [1]. E-learning is described as an attempt to connect students who are physically distant and separated from their learning materials (i.e., databases, experts/teachers/lecturers, and libraries). The interactions of relationship between the elements are carried out either directly or indirectly [2]. The E-Learning usage on learning process is encouraging the accumulation of its quality for students or user, due its complexity and ubiquitous [3]. However, the operation of some features in using the learning website is quite complicated and time consuming occasionally [4]. Thus, it become an issue and causing some students face the difficulties in using it. This is due the website to be less effective and efficient for some students [5]. Hence, it is necessary to carry out Usability Test to ensure the website's effectiveness and efficiency. Usability is defined as a measure that describes how the software product is in accordance with the original purpose of its development [6].

A test is required to measure and investigate the user experience when visiting the learning websites. The eye tracking method is the one of observation method that has the advantage of monitoring the user's eye movements directly while accessing the website [7]. The method explains that the recorded of users' eye movements is able to illustrate their experiences in interacting with the display of websites [8]. Eye tracking is finding an individual's eyes when moving [9]. The eye tracking is a technique that assists researchers in understanding visual attention to identify where, for how long, and the order in which an individual looked while visiting a website [10].

The results of this analysis are useful for evaluating whether the learning website is sufficient to satisfy users or needs to be evaluated based on the findings of the tests that will be carried out later. Therefore, this paper aims to discover how the effectiveness and efficiency of a learning website by employing the eye tracking method as the usability test means.

2. Methodology

The research was conducted in several phases, starting from preparing tasks for the respondents until analyzing the usability attributes. This section explains all the procedures that have been operated from all of the research phases.

A. Preparing Tasks

There are three main tasks that offered to the respondents. The tasks are regarding to the users' responsiveness to find certain object on the website. Table 1 shows list of tasks that used in this study.

Table 1
List of the respondents' tasks

Task	Description
Find the assignment submission column on the learning website	Respondents search a column to submit assignments
Find a discussion forum on the learning website	Respondents search the discussion forums to answer or ask questions in the forum.
Find the chat column with lecturers on the learning website	Respondents search the chat columns or send messages to lecturers

B. Implementation of Eye Tracking

Eye tracking was carried out for each sample in turn until it was finished.

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C. *Data Collection*

The data obtained from data collection is then carried out:

1. Task processing time calculation.
2. Calculating the number of completed tasks.
3. Calculating the number of uncompleted tasks.

D. *The Usability Analysis*

The website usability is analyzed by determination of the effectiveness by using Equation (1) and the efficiency by using Equation (2) and (3).

$$Effectiveness = 100\% \frac{total\ completed\ tasks}{total\ tasks} \quad (1)$$

1. Time Based Efficiency (TBE)

$$TBE = \frac{\sum_{j=1}^{R}\sum_{i=1}^{N}\frac{nij}{tij}}{NR} \quad (2)$$

2. Overall Relative Efficiency (ORE) (%)

$$ORE = 100\% \frac{\sum_{j=1}^{R}\sum_{i=1}^{N} nijtij}{\sum_{j=1}^{R}\sum_{i=1}^{N} tij} \quad (3)$$

3. Results

A. *Experimental Data*

1) *Heatmap*

1. Task 1

Fig. 1. Heatmap Task 1

Based on the Fig. 1. it can be seen that the target or targets from Task 1 and its surroundings show a heatmap with the most prominent color, which is red, which means that most or the totality of the respondents can see the target that has been determined.

2. Task 2

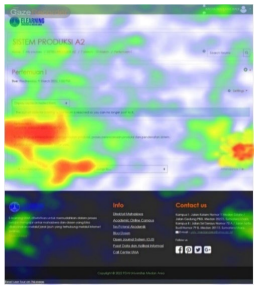

Fig. 2. Heatmap Task 2

According to Fig.2, it can be seen that the heatmap shows the most prominent color, which is red in three areas, namely the target area of Task 2 that has been determined, and two other areas. Which means that the average totality of respondents can see the target that has been determined and see two other areas that are not included in the target of Task 2.

3. Task 3

Fig. 3. Heatmap Task 3

Based on the Fig. 3, it can be seen that the heatmap shows the most prominent color, which is red in two areas, namely the target area of Task 3 which has been determined, and two other areas. Which means that the average totality of respondents can see the target that has been determined and see other areas that are not included in the target of Task 3.

2) *Area of Interest*

1. Task 1

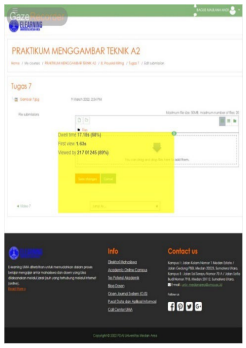

Fig. 4. Area of Interest Task 1

Based on the Fig. 4, it can be seen that 217 out of 245 respondents or around (89%) of respondents see the target or goal of Task 1 which has been determined.

2. Task 2

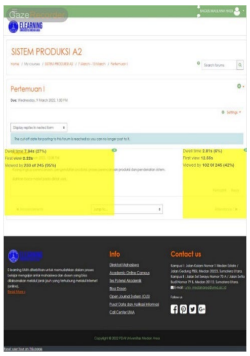

Fig. 5. Area of Interest Task 2

According to Fig. 5, it can be seen that 102 out of 245 respondents or around (42%) of respondents see the target or goal of Task 2 that has been determined.

3. Task 3

Fig. 6. Area of Interest Task 3

Based on the Fig. 6, it can be seen that 119 of the 245 respondents or around (49%) of respondents saw the target or objectives of the predetermined Task 3.

B. Period of Experimental Results and Task Execution

1) Effectiveness

The effectiveness is measured by using Equation (1) for each task that has been completed by respondents. A total of 438 tasks were successfully completed from 245 respondents. Task 1 was totaled as 217, Task 2 was 102, and Task 3 was 119. The following is the calculation of the level of effectiveness for each task.

$$Task\ 1 = 100\%\frac{217}{245} = 88{,}57\%$$

$$Task\ 2 = 100\%\frac{102}{245} = 41{,}63\%$$

$$Task\ 3 = 100\%\frac{119}{245} = 48{,}57\%$$

2) Efficiency

The efficiency is measured by using Equation (2) for calculating the TBE value for each task and Equation (3) for the ORE value. The following is the calculation of the level of effectiveness for each task.

1. Time Based Efficiency (TBE)

$$\text{TBE } Task\ 1 = \frac{\frac{1}{21}+\frac{1}{20}+\frac{1}{19}+\frac{1}{25}+\cdots+\frac{1}{24}}{1\times 245} = 0.038\ goals/sec$$

$$\text{TBE } Task\ 2 = \frac{\frac{1}{16}+\frac{0}{30}+\frac{0}{30}+\frac{1}{17}+\cdots+\frac{1}{21}}{1\times 245} = 0.024\ goals/sec$$

$$\text{TBE } Task\ 3 = \frac{\frac{1}{15}+\frac{1}{12}+\frac{1}{23}+\frac{1}{16}+\cdots+\frac{0}{30}}{1\times 245} = 0.031\ goals/sec$$

2. Overall Relative Efficiency (ORE) (%)

$$\text{ORE } Task\ 1 = \frac{(1\times 21)+(1\times 20)+\cdots+(1\times 24)}{5984}\times 100\% = 85{,}99\ \%$$

$$\text{ORE } Task\ 2 = \frac{(1\times 16)+(0\times 30)+\cdots+(1\times 21)}{5984}\times 100\% = 29{,}83\ \%$$

$$\text{ORE } Task\ 3 = \frac{(1\times 21)+(1\times 20)+\cdots+(1\times 24)}{5984}\times 100\% = 34{,}44\ \%$$

C. Period of Experimental Results and Task Execution

Based on the results data processing, the level of effectiveness and efficiency is obtained. The following Table 2 shows the average level of effectiveness and efficiency based on the results of data processing.

Table 2
The average level of effectiveness and efficiency

No.	Task	Effectiveness	TBE	ORE
1	Task 1	88,57%	0.038 goals/sec	85,99%
2	Task 2	41,63%	0.024 goals/sec	29,83%
3	Task 3	48,57%	0.031 goals/sec	34,44%
Average		60,00%	0,031 goals/sec	50.09%

As shown in Table 2, there are 2 ineffective tasks with a percentage level of effectiveness of 41.63% and 48.57%. So, it is necessary to make improvements to the appearance of the learning website.

4. Conclusion

Based on the results of calculating the levels of Effectiveness, Efficiency and AOI (Area of Interests) calculations from several tasks, it is obtained:

1) Effectiveness

Based on the level of effectiveness calculation, Task 1 has percentage of 88.57%, 41.63% for Task 2 and 48.57% for Task 3.

2) Efficiency

Based on the calculation of the efficiency level, TBE Task 1 = 0.038 goals/sec, TBE Task 2 = 0.024 goals/sec, TBE Task 3 = 0.031 goals/sec And ORE Task 1 = 85.99%, ORE Task 2 = 29.83%, ORE Task 3 = 34.44 %.

Based on the AOI calculation, the researcher provides suggestions for improvements to the E-learning, namely by moving the targets that have been determined in the Area of Interest.

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