The Indonesian Journal of Computer Science
www.ijcs.net
Volume 14, Issue 3, June 2025
https://doi.org/10.33022/ijcs.v14i3.4516

The Use of Mixed Methods Usability Testing (Eye Tracking Method and Cognitive Walkthrough) (Case Study: Website of The Department of Information Systems, Faculty of Computer Science, Sriwijaya University)

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Article Information

Received : 22 Nov 2024
Revised : 27 Apr 2025
Accepted : 9 Jun 2025

Keywords

Eye Tracking method, cognitive walkthrough, User Experience, User Interface, Universitas Sriwijaya, Website

Abstract

Universitas Sriwijaya is one of the state universities in Indonesia. Universitas Sriwijaya has 10 faculties, one of which is the Faculty of Computer Science. Information Systems is one of the departments in the Faculty of Computer Science, Sriwijaya University. Based on the observation results, the Department of Information Systems has just updated the appearance of its website. To determine the level of usability of the website, this research uses two methods, namely eye-tracking method and cognitive walkthrough. The activities that are the research material in this research include searching for lecturers' schedules, downloading final project guidelines and searching for course codes. As a result of the cognitive walkthrough method, the activity of searching for lecturers' timetables has the lowest success rate of 0%, followed by the activity of searching for course codes with 40% and the activity of downloading final project guidelines with 80%. In addition, the research continued using the eye-tracking method to identify areas of confusion for the respondents and to understand the emotional level of the respondents when carrying out these activities. It can be seen that the average respondent is still confused or unfocused when working on the pre-defined activities.

A. Introduction

A website is a page consisting of images, text, and other multimedia components that are displayed digitally [1]. Nowadays, websites are not only useful for IT people, but websites can also be used for business development, increasing credibility, and saving the cost of promoting a product [2].

Universitas Sriwijaya is a public university located in South Sumatra Province. Universitas Sriwijaya has ten faculties since its establishment until now [3]. The Faculty of Computer Science is one of the faculties in Universitas Sriwijaya. The Faculty of Computer Science has three departments, namely Information Systems, Computer Systems, and Informatics. Since its establishment, the Department of Information Systems, Faculty of Computer Science, Sriwijaya University has utilised the website as a medium for sharing information. The Information Systems Department's website has been updated both in terms of content and components of the website itself. The users of the Department of Information Systems website are students, lecturers, and staff of the Department of Information Systems, Faculty of Computer Science, Universitas Sriwijaya.

Based on observations and interviews with the management staff, the website of the Department of Information Systems, Faculty of Computer Science, Universitas Sriwijaya was last updated in 2023. The users of the Department of Information Systems website, which are dominated by students, have different reactions to the last update made by the Department of Information Systems, Faculty of Computer Science, Sriwijaya University. The current condition of the Department of Information Systems website has never been evaluated in terms of the features and appearance updates that have been made.

Usability testing is a method used to quantitatively measure the usability of an information system [4]. The aim of usability testing is to increase the level of usability of existing information systems [5]. There are methods that can be used when conducting usability testing, including the System Usability Scale (SUS) [6], Task Centered System Design (TCSD) [7], User Experience Questionaire (UEQ) [8], End User Computing Satisfaction (EUCS) [9], and Cognitive Walkthrough [10].

Cognitive walkthrough is one of the usability testing methods that can be used to measure the usability of an information system. This method tends to analyse how users understand and are able to use the user interface of a system (11). This method assesses the level of usability of an information system by looking at the steps taken by users in carrying out predetermined activities.

Based on this, the author believes that the Cognitive Walkthrough method can be used to measure the level of usability of a system. However, by using the Cognitive Walkthrough method, the author cannot analyse which areas of a user interface make users interested or even confused. Therefore, the author is interested in combining the Cognitive Walkthrough method with the Eye Tracking method in order to evaluate the level of usability of a system or website in terms of both time efficiency and the user's point of view of the user interface.

B. Research Method

This research uses the participatory action research framework, which consists of 4 stages, namely planning, action, observation and reflection. The framework is shown in Figure 1 below

Figure1. Framework Participatory Action Research

Plan

This phase consists of three activities, namely research planning, task preparation and respondent identification. In the research planning activity, the researchers planned the object of the research study and the methods to be used in this research. In the Task Preparation activity, the researchers divided the roles and responsibilities of the work for each member of the research, both lecturers and students. In the respondent selection activity, the researchers selected the respondents who would later become the object of the research.

Action

This phase consists of three activities, testing, implementing the cognition walkthrough, implementing the eye tracking method. The trial activity will be divided into two trials, namely trials using cognition walkthrough and trials using eye tracking. Before the experiment is carried out, the respondents are explained the tasks they have to carry out according to what has been agreed in the planning phase. Then each respondent tries to complete the given task.

Observation

This phase consists of three activities, reviewing the results of the number of tasks completed, reviewing the task completion time, analysing the heat map, analysing the area of interest. The three activities in this phase are a continuation of the previous phase, the action phase. In this phase the researcher reviewed the results of the completion of the tasks carried out by the respondents. The things that

were studied included the respondents' area of interest and also the heat map of the study results.

Reflection

This phase consists of three activities, summarising the results of user experience, providing suggestions related to heat maps and areas of interest from the research results, providing suggestions for improvements related to UI/UX. From the results of the analysis of the observation phase, the researchers provide improvements to the UI/UX so that it can increase user satisfaction in the future on the website of the Department of Information Systems, Faculty of Computer Science, Universitas Sriwijaya.

C. Result and Discussion

In carrying out this research, the researcher has selected certain tasks to be carried out by the respondents. The tasks are shown in Table 1 below. From all these tasks, the respondents' activities are analysed using two methods, namely cognitive walkthrough and eye-tracking.

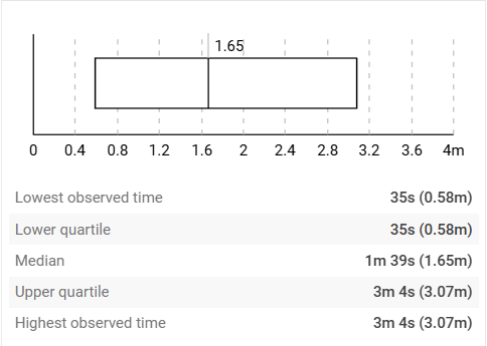
Table 1. Research Task Scenario

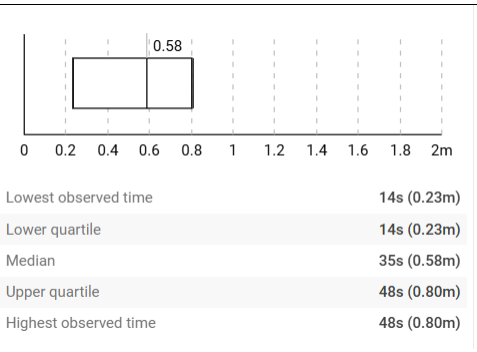
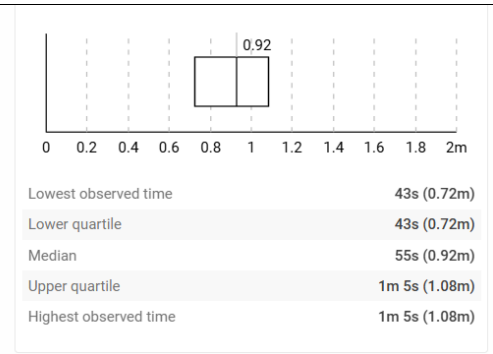
No	Task Name	Description
1	Search for Lecturer Schedule	Respondents search for the name of a particular lecturer and look for the lecturer's timetable on a given day.
2	Download the Final Project Guide	Respondents can download student final project guidelines
3	Search for Course Code	Respondents looking for a specific course code

Cognitive Walkthrough

The first method used to analyse the results of activities performed by respondents is cognitive walkthrough. This method provides analysis in the form of user success rates and average user time in performing previously given tasks. The experiments were carried out with 5 respondents. The results are shown in the table below.

Table 2. Success Rate & Average Time

Task	Success	Failed	Success Rate	Average Time
Search for Lecturer Schedule	0	5	0%	

Download the Final Project Guide	4	1	80%	
Search for Course Code	2	3	40%	

Based on the results of the analysis using the cognitive walkthrough method, the activity of finding a lecturer's timetable has a success rate of 0%, where none of the 5 respondents managed to complete the activities performed, with an average completion time of 1 minute 39 seconds. While the activity of downloading the final assignment guidelines has a success rate of 80%, for an average time to complete the activity of 35 seconds. For the third activity, finding the course code, the success rate is 40%, with an average time of 55 seconds.

From the results of this comparison, it can be concluded that the activity that has the lowest success rate is looking for a lecturer's schedule, then looking for a course code, and downloading final project guidelines. For the average work has the same order as the success rate, namely, the lowest activity is looking for a lecturer schedule, then followed by looking for a course code, and downloading the final project guidelines.

Eye Tracking Method

1. *Data Quality of Eye Tracking Test Results*

The quality of *eye tracking* test data on each *task* can be seen in the following Tables 1-3.

a) *Data quality of Task 1 (Search for Lecturer Schedule) test results*:

Table 3. Data Quality of Task 1 Results

Respondent	*E-T Data Grade*	*E-T Data Integrity*	*Gaze On Screen*
Respondent 1	Very Good	99%	97%
Respondent 2	Very Good	97%	99%
Respondent 3	Low	61%	90%
Respondent 4	Very Good	98%	99%
Respondent 5	Average	98%	77%

b) *Data quality of Task 2 (Download the Final Project Guide) test results*:

Table 4. Data Quality of Task 2 Results

Respondent	*E-T Data Grade*	*E-T Data Integrity*	*Gaze On Screen*
Respondent 1	Very Good	96%	100%
Respondent 2	Average	96%	73%
Respondent 3	Very Low	49%	94%
Respondent 4	Good	99%	88%
Respondent 5	Very Good	98%	100%

c) *Data quality of Task 3 (Search for Course Code) test results*:

Table 5. Data Quality of Task 3 Results

Respondent	*E-T Data Grade*	*E-T Data Integrity*	*Gaze On Screen*
Respondent 1	Very Good	96%	100%
Respondent 2	Very Good	97%	97%
Respondent 3	Low	61%	86%
Respondent 4	Perfect	100%	100%
Respondent 5	Very Good	97%	98%

From those three *tasks* that have been carried out, *Task* 1 has an average *E-T data integrity* value of 90.6% with *gaze on screen of* 92.4%. *Task* 2 has an average *E-T data integrity* value of 87.6% with a *gaze on screen of* 91%. *Task* 3 has an average *E-T data integrity* value of 90.2% with a *gaze on screen of* 96.2%. Thus, the overall average *E-T data integrity* score is 89.47% and the average *gaze on screen* score is 93.2%, with the overall *E-T data grade* being *very good*. This indicates that overall the data from the *Eye Tracking* test is recorded very well and precisely, and has excellent data integrity and focus on the screen as well.

2. *Eye Tracking Data Analysis*

The following is *eye tracking* test data, in the form of visualization *heatmaps* and *attention* & *emotion* graphs obtained from *eye tracking* tests using *RealEye.io*.

a) *Task 1 (Search for Lecturer Schedule)*

In this *Task* 1, none of the respondents were able to find the lecturer's schedule that had been determined completely. The results of *heatmaps* visualization and *Task* 1 *attention & emotion* graphs for each respondent are as follows.

Heatmaps R1 T1

R1 T1

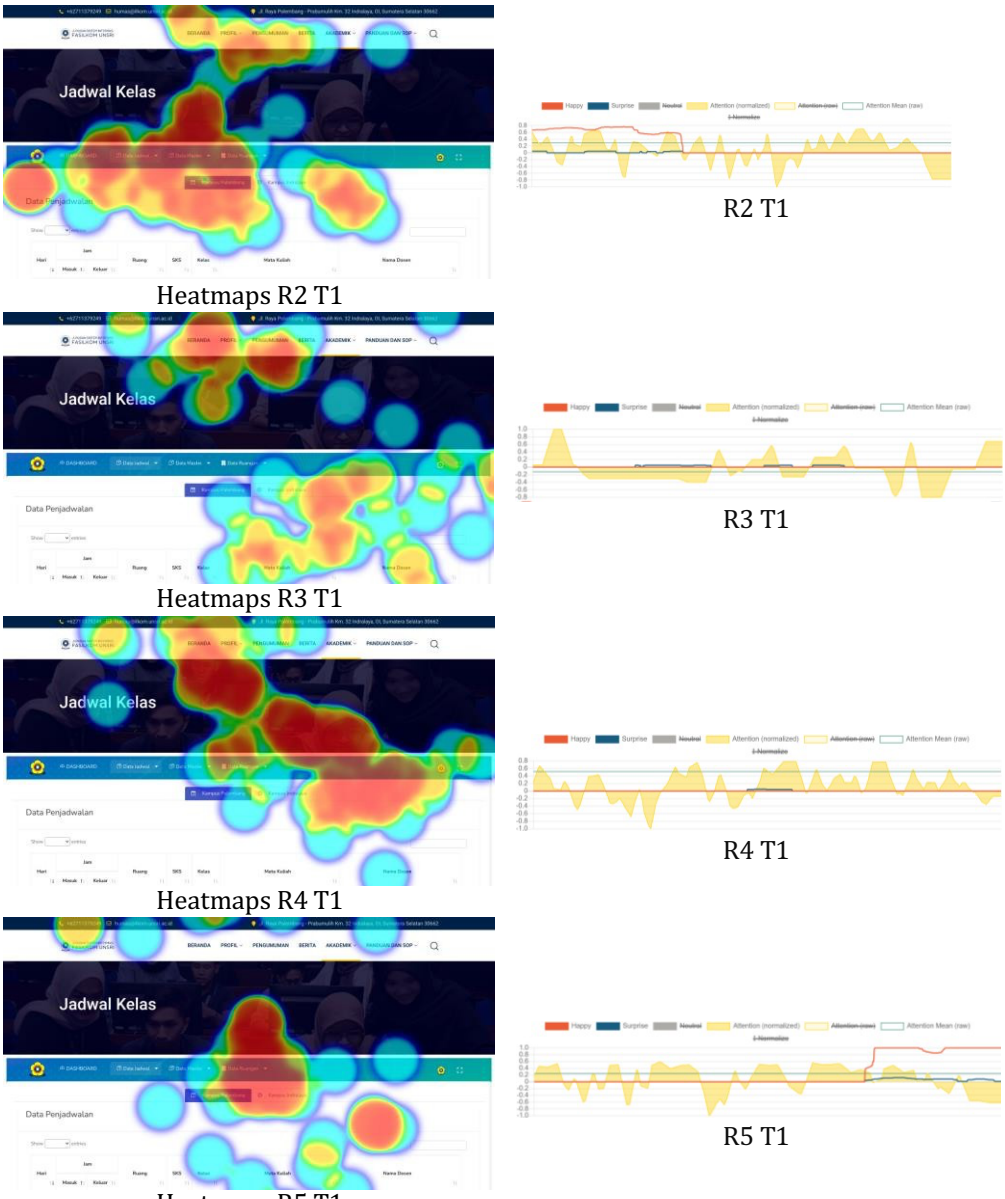
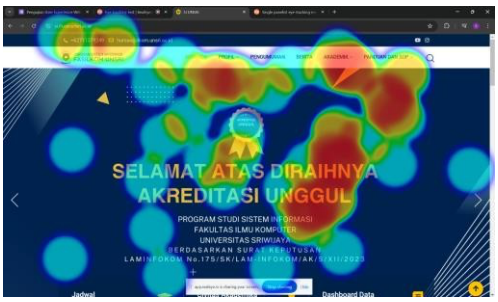


Figure 2. Heatmaps and Attention & Emotion Graph Task 1

Based on the *heatmaps* and *attention* & *emotion* graph in *Task* 1 above, it can be seen that the focus of respondents' attention is spread in the center and right of the *web* page, as well as in the navigation menu area and its surroundings. With the dominant red-colored area on the right in the *heatmaps*, it shows that the respondent's focus is on the "Lecturer Name" column area, and some scattered views on the right show the respondent's attention to the "Day" column. However, the test results show that some respondents found the correct but incomplete schedule. This shows an indication of the confusion experienced by respondents in searching for lecturer schedules. The *attention* & *emotion* graph shows that the average attention level of respondents ranges from -0.12 to 0.52, with almost all respondents experiencing an increase in *surprise* and *happy* emotions at various moments, while Respondent 1 did not show an increase in emotion. The increase in emotion experienced by more respondents is the emotion of *surprise*.

b) ***Task 2 (Download the Final Project Guide)***

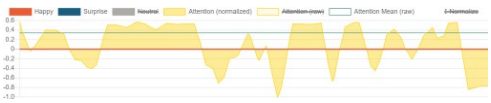
In this *Task* 2, 4 respondents successfully completed the *task*. Meanwhile, 1 other respondent, namely Respondent 3, did not successfully complete the *task of* downloading the Final Project guidance document. The visualization results of *heatmaps* and *Task* 2 *attention & emotion* graphs for each respondent.



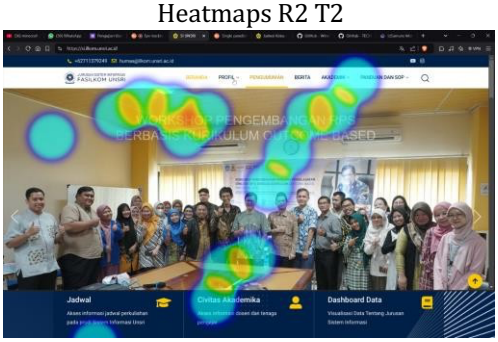
Heatmaps R1 T2

R1 T2

Heatmaps R2 T2



R2 T2



Heatmaps R3 T2

R3 T2

Heatmaps R4 T2

R4 T2

Heatmaps R5 T2

R5 T2

Figure 3. Heatmaps and Attention & Emotion Graph Task 2

Based on the heatmap results and the Attention & Emotion graph in Task 2 for the five respondents, it can be seen that the focus of the respondents' attention is mostly in the navigation menu area and its surroundings, as well as in the centre of the web page. Respondents 1 and 2 had clicked on the "Pedoman Tugas Akhir" sub-menu, which was just above the "Panduan Tugas Akhir" sub-menu. Then, when the "Panduan Tugas Akhir" page was successfully opened, the attention of respondents 1 and 2 was on the download button area of the final project guidelines document. There is also a significant increase in Respondent 1's surprise and happiness emotions, which shows that Respondent 1 tends to experience confusion, especially when clicking on submenus. In Respondent 2's heatmaps, the red areas that dominate in the corners of the page indicate an average level of data quality, making the resulting data less accurate. In this task Respondent 2 did not experience an increase in emotion. Similar to respondent 2, respondent 3 has very low data quality, so the resulting data is not accurate. This may be due to the fact that respondent 3 did not pay enough attention to the screen as he stated that he was confused. This can be seen in the dominant blue heatmaps around the navigation menu and the centre of the web page. Not much attentional focus was recorded in the Attention & Emotion graph, and respondent 3 was unsuccessful in completing this task. Respondents 4 and 5 managed to complete the task and showed no signs of confusion, with predominantly red areas in the centre of the page and around the navigation menu. Respondent 4 did not experience any significant changes in emotion, but respondent 5 experienced a slight increase in the emotion of surprise in the middle of the test. The *attention* & *emotion* graph shows that the average attention level of respondents ranged from 0.03 to 0.43, with some respondents experiencing an increase in the emotion of *surprise* and *happy* at various moments, where the increase in emotion experienced by more respondents was the emotion of *surprise*.

c) *Task 3 (Search for Course Code)*

In this *Task* 3, 2 respondents failed to find Thesis Course Code information, 3 respondents successfully found Thesis Course Code information. Below are the visualization results of *heatmaps* and *attention & emotion* graphs for *Task* 3.

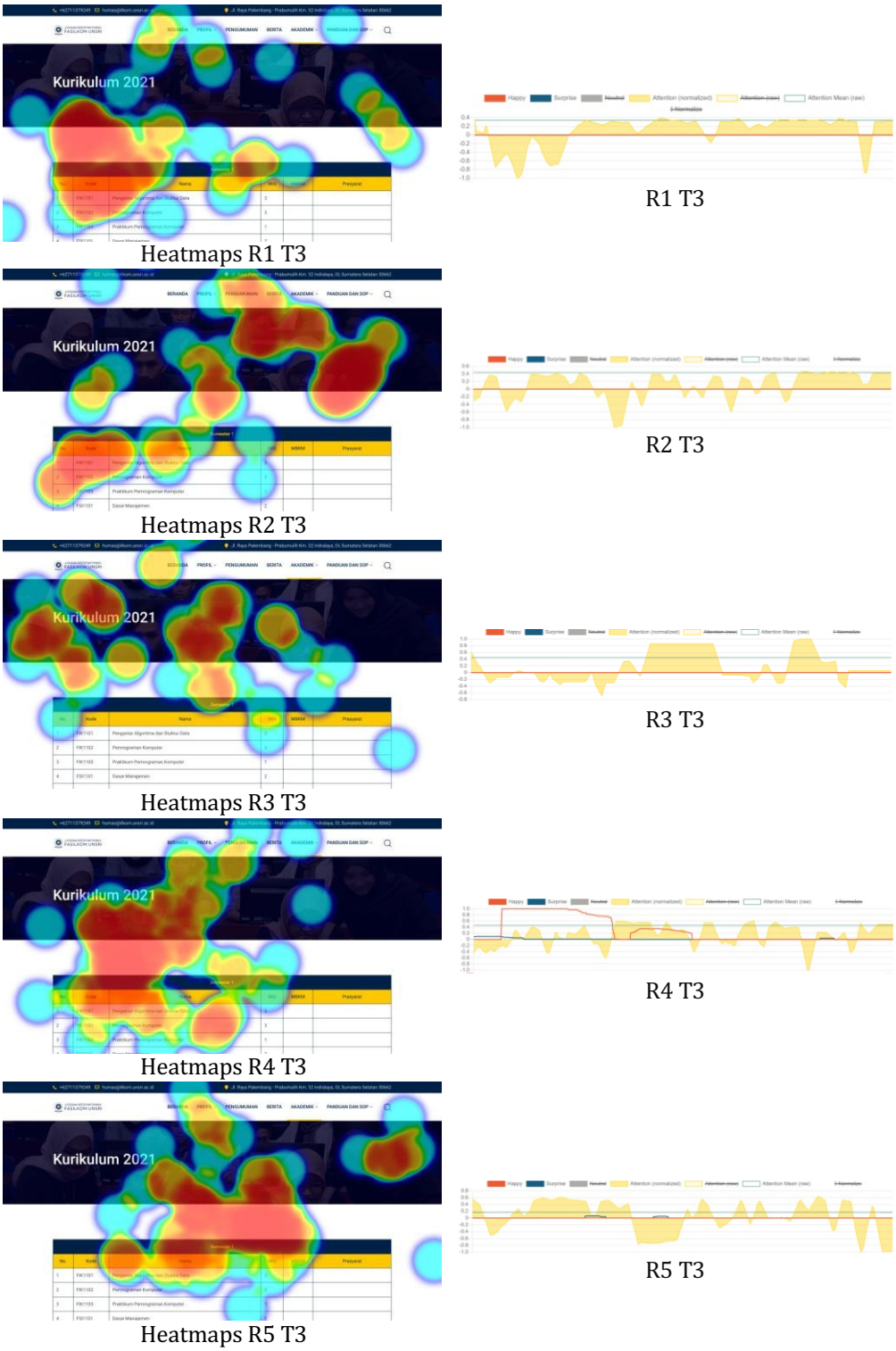


Figure 4. Heatmaps and Attention & Emotion Graph Task 3

Based on the heatmaps and attention & emotion graphs in Task 3 from the five respondents, it can be seen that the focus of the respondents' attention is spread over the centre of the web page as well as the navigation menu area and its surroundings. The dominant red area on the left in the heatmaps of respondents 1, 3 and 5 shows that the respondent's focus is in the area of the course 'Kode' column.

Meanwhile, for respondents 2 and 4, the dominant red coloured area on the right shows that the respondent's attention is in the area of the course 'Prasyarat' code column. This is an indication of the difficulty in finding the course code. The attention & emotion graph shows that the average respondent's attention level ranges from 0.17 to 0.46, with most respondents showing no increase in emotion and some respondents showing an increase in surprise and happy emotions. Analysis of the heatmaps and attention & emotion graphs shows that most respondents experience confusion when searching for course codes, as evidenced by the increase in emotions, with the emotion of surprise being experienced more often.

From the results of the analysis of the attention & emotion graph for each respondent, the average attention level in Task 1 is 0.218, in Task 2 it is 0.276 and in Task 3 it is 0.372. Overall, the respondent's average attention level is 0.288, indicating that the respondent's gaze fixation is relatively short, followed by a relatively long saccade, with the respondent experiencing a greater increase in the emotion of surprise than in the emotion of happiness. The respondents indicated that they tend to experience confusion when working on the tasks, especially when working on Task 1, the attention of most respondents is distributed in the area around the top of the page, namely the navigation area. Judging from the heatmap analysis, some respondents' attention was not focused on the location between Bukit Campus and Indralaya Campus, so there were respondents who continued to look for timetables on the Bukit Campus page. Then, when scrolling down the schedule page, it can be seen that most respondents have difficulty finding lecturers' schedules on certain days. This indicates that some respondents may be experiencing confusion, as indicated by the increase in the emotion of surprise.

D. Conclusion

This research combines Cognitive Walkthrough and Eye Tracking methods in conducting usability testing of the Information Systems Department's website at Universitas Sriwijaya. The activities analysed in this case study are finding lecturers' timetables, downloading final project guidelines and finding course codes. From the analysis using the cognitive walkthrough method, it was concluded that of the three tasks given, the most difficult task was finding the lecturer's schedule with a success rate of 0%, followed by finding the course code with 40% and downloading the final project guidelines with 80%. These results were analysed using the eye-tracking method. From those three tasks that have been carried out, the overall average E-T data integrity score is 89.47% and the average gaze on screen score is 93.2%, with the overall E-T data grade being very good. This indicates that overall the data from the Eye Tracking test is recorded very well and precisely, and has excellent data integrity and focus on the screen as well. From the heatmaps visualization of the test results, it can be seen that respondents tend to have difficulty in finding the information they need, because the layout of the lecturer schedule information is not well grouped and the position of the button between ‘Kampus Bukit’ and ‘Kampus Indralaya’ does not get the attention of respondents, as well as the similarity between the ‘Kode’ of the course and the ‘Prasyarat’ of the course makes respondents tend to confuse the two information. In addition, most respondents

also indicated difficulty in distinguishing between the 'Panduan Tugas Akhir' and 'Prosedur Tugas Akhir' submenus, especially since they were close together and not very large. However, after successfully opening the 'Panduan Tugas Akhir' page, respondents can download the 'Panduan Tugas Akhir' document easily. This is supported by the attention & emotion graph which shows that in each task, the most emotion increase experienced by respondents is the emotion of surprise, with the overall average respondent's attention level being 0.288, indicating that the respondent's gaze fixation is relatively short, followed by a relatively long saccade, which indicates that the respondent is indicated to experience confusion in performing the task.

The findings of this study indicate that there are areas that need to be improved and enhanced in the layout and clarity of the website's user interface (UI) to increase user satisfaction, especially in terms of navigation and content visibility. These adjustments will support more efficient information retrieval and an overall better user experience.

E. Acknowledgment

The research /publication of this article was funded by DIPA of public Service Agency of Universitas Sriwijaya 2024 Nomor SP DIPA 023.17.2.677515/2024, On November 2024, 2023. In accordance with the Rector's Decree Number: 0013/UN9/LP2M.PT/2024, On May 20, 2024

F. References

[1] N. Brügger, "Website history and the website as an object of study," *New Media Soc.*, vol. 11, no. 1–2, hal. 115–132, 2009.

[2] D. Maharani, F. Helmiah, dan N. Rahmadani, "Penyuluhan Manfaat Menggunakan Internet dan Website Pada Masa Pandemi Covid-19," *Abdiformatika J. Pengabdi. Masy. Inform.*, vol. 1, no. 1, hal. 1–7, 2021.

[3] D. Eka, Y. Hamdaini, dan S. Karim, "Kualitas Pelayanan Fakultas Ekonomi Universitas Sriwijaya," *J. Manaj. Dan Bisnis Sriwij.*, vol. 16, no. 2, hal. 89–98, 2018.

[4] S. Ernawati dan S. Rahayu, "Analisa Usability Pada Aplikasi Identitas Kependudukan Digital Menggunakan Metode Usability Testing," *BIOS J. Teknol. Inf. dan Rekayasa Komput.*, vol. 5, no. 1, hal. 12–19, 2024.

[5] J. S. Dumas dan J. E. Fox, "Usability testing," *human-computer Interact. Handb. Fundam. Evol. Technol. Emerg. Appl.*, hal. 1221–1241, 2012.

[6] A. Saputra, "Penerapan Usability pada Aplikasi PENTAS Dengan Menggunakan Metode System Usability Scale (SUS)," *JTIM J. Teknol. Inf. dan Multimed.*, vol. 1, no. 3, hal. 206–212, 2019.

[7] Z. I. P. Hardianto dan Karmilasari, "Analysis and Design of User Interface and User Experience (UI/UX) E-Commerce Website PT Pentasada Andalan Kelola Using Task System Centered Design (TCSD) Method," in *2019 Fourth International Conference on Informatics and Computing (ICIC)*, 2019, hal. 1–8.

[8] E. Apriliyanto dan A. A. R. Nugroho, "Analysis Usability Of User Experience Of

The Srawung with The User Experience Questionnare (UEQ) Method," *Julia J. Ilmu Komput. An Nuur*, vol. 3, no. 1, hal. 1–7, 2023.

[9] A. R. Yudistira, H. H. Nuha, dan K. A. Achmad, "User Satisfaction Analysis of PeduliLindungi Application Using End User Computing Satisfaction (EUCS) Method," in *2022 9th International Conference on Electrical Engineering, Computer Science and Informatics (EECSI)*, 2022, hal. 193–197.

[10] M. Farzandipour, E. Nabovati, H. Tadayon, dan M. S. Jabali, "Usability evaluation of a nursing information system by applying cognitive walkthrough method," *Int. J. Med. Inform.*, vol. 152, hal. 104459, 2021.