# Usability Analysis of Interactive Display Technology for Academic Purpose

Rania Hana Kamila and Dyah Santhi Dewi
Department of Industrial and Systems Engineering, Institut Teknologi Sepuluh Nopember
*e-mail*: dyah@ie.its.ac.id

***Abstract*—In the implementation of formal education, educators and students are required to be more creative to achieve the expected educational goals. An educator must be able to master the method and selection of appropriate media in teaching. One of them is using interactive display as it becomes use widely especially for online class. Interactive display investment cost is quite expensive. However, the display has not been utilized properly using the available features in there. Therefore, this study will conduct the usability testing of interactive display in academic settings, do the usability analysis by focusing on efficiency, utility, and learnability of the interface, and provide recommendation of interactive display utilization by considering user experience (UX). Data collecting will be done by testing the interactive display on respondents which are students and lecturer representative. Data collected are completion time and respondent responses and perception on interactive display. Responses are collected with method of Retrospective Think Aloud (RTA) which allow respondents to deliver their responses after testing hence it does not disturb respondents during the testing. According to testing activity, respondents did not face significant difficulties when performing usability testing task since the features and tools are resembled to similar application and software. However, since it is the first-time respondents use interactive display based on the requested tasks, there are some confusions on interactive display such as use of Screen Share to do presentation and some tools on Whiteboard and Annotate. Total score of System Usability Scale (SUS) is 66.61 which is categorized as marginal acceptable range and need to improve the usability of interactive display. Recommendation given are in the form of suggestions for using the interactive display in lecture activity to support interactive class.**

***Keywords*—Ergonomics, Interactive Display, Retrospective Think Aloud (RTA), System Usability Scale (SUS), Usability**

## I. INTRODUCTION

LEARNING is a process that is carried out both through formal and non-formal education. In the implementation of formal education, educators and students are required to be more creative to achieve the expected educational goals. An educator must be able to master the method and selection of appropriate media in teaching. Quality and innovative learning is inseparable from the use of media. During the Covid-19 pandemic, various media, especially online media or learning applications, are used to support online learning such as WhatsApp, Zoom, Google Meet, Kahoot, and many more [1].

Interactive display technology allows users to interact with a computer or other device using touch or digital pen input. Key features of interactive display technology are its large feature with high-resolution display, touchscreen interface, able to connect to computer or other devices, and other software and features that enhance the experience of teaching and learning. In fact, interactive display technology in universities was quite common before the pandemic, because interactive display technology is considered to increase interactivity in learning and provide more interesting learning experience for students. While the pandemic may have accelerated technology adoption in education, the use of interactive display technologies in universities has been increased in recent years and is expected to continue to grow in the future [2].

Table 1.
Task Scenario

| No. | Task Scenario |
|---|---|
| T1 | Participants display files from computer to appear through interactive display using Screen Share App and is able to control computer screen through interactive display |
| T2 | Participants finish the presentation and disconnect between the computer and the interactive display |
| T3 | Participants write two sentences on the Whiteboard in different colors |
| T4 | Participants write two sentences in different size of pen |
| T5 | Participants change the position of the sentences (the sentence at the top is shifted down and the sentence at the bottom is shifted up) |
| T6 | Participants capture the image on the interactive display screen and give a caption (or doodling) on top of the capture |
| T7 | Participants display 2 captures side by side and each image had a whiteboard menu |
| T8 | Participants delete some of the text and restore the text |
| T9 | Participants delete all text on the whiteboard and restore the text and delete text again into clear screen |
| T10 | Participants highlight the text on the interactive display screen |
| T11 | Participants change the size of the pen and highlighter and want to use different colours |
| T12 | Participants pan pages on the interactive display screen without closing the annotate menu |
| T13 | Participants delete some of annotates and marks on the interactive display screen and restore them |
| T14 | Participants delete all annotates and marks and restore them |
| T15 | Participants move the menu on the other side of the screen to be close to the participant's position |

The focus of the research is to evaluate the understand the interactive display technologies by considering the user experience (UX) and maximize its usability. The recommendations are expected to be used uttermost in class to support learning process in class. The scenario tasks are actions that are taken by the participants of the test tool. Scenario tasks provide a context in which scenarios are developed according to real conditions and make it possible for participants working on scenario tasks to take an interest in the tool. Task listed are the chosen ones according to its feature availability which will most likely be used frequently in class activities. The features are Screen Share, Whiteboard, Capture, and Annotate. The result of the research is expected to optimize the use of interactive display, give information about interactive technology and its usability, and expected

Table 2.
Interview Questions List

| No. | Question |
|---|---|
| Q1 | Does participant ever use interactive display before? |
| Q2 | What is participant first impression of the experience? |
| Q3 | What does participant like the most about the experience? (if any) |
| Q4 | What does participant not like or like the least about the experience? (if any) |
| Q5 | How easy or difficult is the task? Please explain your answer. |
| Q6 | What surprised participant about the experience? (if any) |
| Q7 | What is unclear or confusing? (if any) |
| Q8 | If participant could change anything about it, what would they change? |
| Q9 | Is there anything facilitator did not ask to participant about this experience that facilitator should have? |
| Q10 | Do participants think the task can support an interactive class? |
| Q11 | How features can be utilized in a more interactive teaching and learning process? |
| Q12 | What final comments does participant want to make before ending this interview? |

Table 3.
Additional Question

| No. | Question |
|---|---|
| Q13 | I see that you do ... can you explain your thought process? |
| Q14 | You seemed to rush (any act that different from usual). what were you thinking? |
| Q15 | Why did you navigate to (page A) instead of (page B)? |
| Q16 | What motivated you to click (specific interaction)? |
| Q17 | What caused your frustration? (if any) |

Table 4.
SUS Items

| No | Question |
|---|---|
| 1 | I think that I would like to use this system frequently. |
| 2 | I found the system unnecessarily complex. |
| 3 | I thought the system was easy to use. |
| 4 | I think that I would need the support of a technical person to be able to use this system. |
| 5 | I found the various functions in this system were well integrated. |
| 6 | I thought there was too much inconsistency in this system. |
| 7 | I would imagine that most people would learn to use this system very quickly. |
| 8 | I found the system very cumbersome to use. |
| 9 | I felt very confident using the system. |
| 10 | I needed to learn a lot of things before I could get going with this system. |

to be guideline to encourage the usage of interactive display in learning process.

## II. LITERATURE REVIEW

### A. *Interactive Display*

IWB is a touch-sensitive presentation device that is used in connection with a computer and a digital projector. The computer images are displayed on the board by digital projector, where they can be seen and manipulated via touching the board, either with your finger, or with an electronic pen/stylus.

The Promethean ActivPanel Titanium 75" AP7-B75 is an interactive flat panel display designed for educational environments. It is equipped with a 75-inch 4K ultra-high-definition resolution large touch screen, providing teachers and students with a vivid and immersive visual experience.

### B. *System Usability Scale (SUS)*

System Usability Scale (SUS) is one of testing method that provides “quick and dirty” and reliable tool for measuring the usability. The questionnaire is consisted of 10 questions with five response options from Strongly Agree to Strongly Disagree. It can be used to evaluate wide variety of products and services, including hardware, software, mobile devices, websites, and applications [3].

### C. *Retrospective Think Aloud (RTA)*

Retrospective Think-Aloud (RTA) shall be recorded only after completion of the test tasks. The participants will verbalize their thoughts after completing a task or a set of tasks. RTA allows participants to carry out the task by themselves or in silence. Participants are less distracted by what they are doing, and there is no additional influence on the time they are taking to complete their tasks.

## III. METHODOLOGY

### A. *Determination of Object of Observation*

The object of testing is interactive display with specification of Promethean ActivPanel Titanium 75 Inch. The reason for choosing this type since this type is one of interactive display that available in the department and its interface of the product is better than any type of interactive display that available in department.

### B. *Research Instrument*

In this research, there are some instruments used to support the observation. Instruments used are Promethean ActivPanel Titanium 75 Inch interactive display, computer, questionnaire, table, and chair.

Table 5.
Recapitulation of SUS Score

| Respondent ID | SUM (Likert Scale) | SUS Score |
|---|---|---|
| 1 | 27 | 67,5 |
| 2 | 35 | 87,5 |
| 3 | 32 | 80 |
| 4 | 25 | 62,5 |
| 5 | 22 | 55 |
| 6 | 26 | 65 |
| 7 | 17 | 42,5 |
| 8 | 34 | 85 |
| 9 | 24 | 60 |
| 10 | 28 | 70 |
| 11 | 29 | 72,5 |
| 12 | 19 | 47,5 |
| 13 | 18 | 45 |
| 14 | 27 | 67,5 |
| 15 | 27 | 67,5 |
| 16 | 30 | 75 |
| 17 | 22 | 55 |
| 18 | 32 | 80 |
| 19 | 25 | 62,5 |
| 20 | 32 | 80 |
| 21 | 19 | 47,5 |
| 22 | 13 | 32,5 |
| 23 | 30 | 75 |
| 24 | 20 | 50 |
| 25 | 38 | 95 |
| 26 | 31 | 77,5 |
| 27 | 36 | 90 |
| 28 | 25 | 62,5 |
| 29 | 22 | 55 |
| 30 | 25 | 62,5 |
| 31 | 36 | 90 |
| Average | | 66,6129032 |

### C. *Task Scenario Design*

Scenario tasks provide a context in which scenarios are developed according to real conditions and make it possible for participants working on scenario tasks to take an interest in the tool. Task listed are the chosen ones according to its feature availability which will most likely be used frequently in class activities. The features are Screen Share, Whiteboard, Capture, and Annotate. The following Table 1 are the tasks that participants are asked to do.

### D. *Interview Question Design*

After conducting interactive display usability testing, participants will be asked to share and verbalize their thoughts and responses after using interactive displays. This method is called Retrospective Think-Aloud (RTA) where participants will be asked for input about interactive displays. RTA was chosen because it can collect qualitative information related to intentions and reasons from participants during usability testing. There are no specific questions that should be used in using RTA method. Important questions can be asked especially questions related to impressions of products related to usability. The following Table 2 are questions that will be used.

There are also additional questions depending on what participants do when performing tasks. These questions can be asked to hear participants' responses about the way they think when performing tasks. The question is as follows in Table 3.

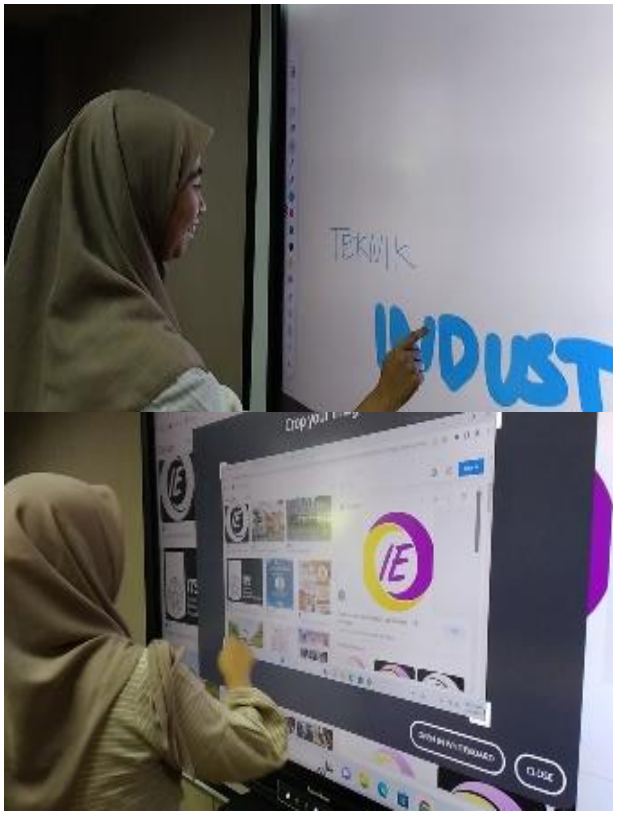

Figure 1. Documentation.

### E. *Questionnaire De sign*

System Usability Scale (SUS) is used to assess how easy it is to use the interactive display. Due to raising participant awareness of the importance of ease and convenience, SUS is chosen. SUS has multiple questions that assess each aspect on a scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Table 4 will show the list of questions.

### F. *Determination of Participant*

The participants will be included thirty students and one representative of lecturer from DTSI to try using interactive display as it is the object of the testing. Participants comes from students and lecturer of Department of Industrial and System Engineering.

### G. *Data Collecting and Processing*

In data processing, quantitative and qualitative data will be collected and processed so that the data can provide information and the data will be analyzed so that conclusions can be drawn. Quantitative data obtained, namely completion time and total score of SUS. Quantitative data will be processed using Microsoft Excel. Next is data analysis and interpretation. This stage will carry out data analysis through various processes to be able to provide information and meaning to the data and produce conclusions. In data analysis and interpretation, quantitative data related to completion time will be analyzed. In addition, the qualitative data which is usability testing results, the participant's response in interview and SUS will be analyzed and the results will be seen in relation to data of completion time. Furthermore, recommendations will be given for interactive display products based on the results of the analysis.

## IV. RESULT AND ANALYSIS

### A. Respondent Profile

Total of respondents in this research are 31 people with 52% of female and 48% of male. All respondents are able to carry out tasks using Windows and Android based interactive display and in good health condition.

### B. Task Scenario Result

Usability testing was conducted with respondents conducting 15 task scenarios which included testing the use of built-in applications from interactive displays such as Share Screen, Whiteboard, and Annotate. During usability testing, respondents will receive an explanation of usability testing activities and what tools will be used and their features. After that, the researcher will read out the task to be done by the respondent. Each task was read one by one before the respondents did it. All usability testing activities are recorded on video. After that, when each respondent completes and successfully completes the task, the researcher will ask respondents about their experience when using interactive displays in order to complete the task scenario. The process is repeated up to 15 times according to the number of tasks. After that, an interview session was held to ask respondents about their general experience in using interactive displays. Respondents spend most of their time when carrying out Task 1, Task 5, and Task 9. The reasons are respondents are experiencing first time to conduct the task which most of them do not familiar with. Also, respondents found some icon in the feature confusing and be hesitant which feature that will done correctly. While Task 2, Task 3, Task 4, Task 6, Task 7, Task 8, Task 10, Task 11, Task 12, Task 13, Task 14, and Task 15 did not face any difficulties since the feature between the Apps are quite similar and also respondents have used similar application before. The analysis of each task will be listed below:

#### 1) Based on Observations

Most respondents spend a long time when working on task 1. This is because respondents have never used the applications and tools used in previous observations. The time span needed for respondents to work on task 1 ranged from 40 seconds to 4 minutes. Respondents 11, 13, 14, 18, 21, 22, 23, 28 and 31 had no difficulty in carrying out task 1.

#### 2) The Respondent Disconnect The Laptop with Interactive Display

Disconnect here the respondent is asked to end sharing screen that has been done in task 1. There are several ways that can be done for end sharing screen on interactive displays. First, respondents can stop sharing the screen by clicking the waiting room icon in the lower right corner of the screen. When the icon is clicked, it will be directed to the waiting room and from there the respondent can end sharing screen. The second, the end sharing screen button appears on the top screen if the respondent clicks Share Screen App. The end sharing screen button only appears if you click Share Screen App. The third is by way of end sharing screen through Share Screen software on the laptop. This method can be done through a laptop directly or open the software through the share screen because the position when asked to do this second task the laptop screen has been shared on the interactive display. Based on observations, 6 respondents used the first method, 3 respondents used the second method, and 21 respondents used the third method where 15 respondents opened the laptop screen share software through the display and 6 respondents through the laptop directly. As for 1 respondent using a similar method to the first way, it is just that respondents with respondent ID R1 open the display menu and click the back button that directs to the waiting room.

#### 3) Write in The Whiteboard App Using The Existing Pen

This task also asks that the writing use two different colors to see the respondent's ability to use the features in this task, namely the feature for writing. Based on observations, all respondents did not experience difficulties in doing the task because in addition to tasks that were not difficult, the icons in the Whiteboard tool also quite clearly illustrate its usefulness such as a pen logo for writing and a clear color palette. The ease of respondents in understanding the usefulness of existing tools is based on the experience or knowledge of similar tool functions. The use of applications or software on other gadgets is knowledge for respondents that similar icons show similar functions to applications or software that have been used before.

#### 4) Scenario for Writing in The Whiteboard App

As well, at this point respondents were asked to write with two different pen sizes. Based on the fourth task command, respondents are divided into two in completing the task, respondents who change the pen size by double-clicking on the icon where the option to change the pen size will appear and respondents who use another tool, namely the highlighter located under the pen tool.

#### 5) Scenarios to Shift or Move The Text That Has Been Written

In the Whiteboard App, existing text or text can be shifted or moved. The trick is to use the selector tool that has a cursor icon on the toolbar and the desired text can be shifted. Based on the results of usability testing, most respondents do not take long to be able to find the right tool even though this is their first time using an interactive display. 27 respondents took less than 1 minute to complete the task. While the remaining four respondents took more than 1 minute to find the right tool. The experience of using similar applications with Whiteboard supports respondents in working on tasks even though there are different perceptions about the alleged functions of existing tools. Because the tool itself does not have a description of the name of the tool, respondents tried several tools that they felt could run task commands. There are several types of users in usability testing. The first is respondents who immediately know the tool used, namely the selector tool and then shift the existing text. The second is respondents who try to select the area to select the text you want to shift. This results in the Whiteboard shifting instead of text shifting or moving. Some respondents assume that the method used is to select the area on the screen where the existing content or text wants to be moved. Most similar apps usually use this method to move objects on the screen. Another tool that is also an initial guess has a function to select the area where the object you want to move is the background tool. The background tool contains options to change the background of the Whiteboard board such as changing the background color or changing the pattern of the

screen background.

*6) Scenarios to Delete Certain Parts of The Text or Text On The Screen*

After that, respondents were also asked to undo the deleted text so that it reappeared. Tasks are created and selected to demonstrate how tools would be used in everyday learning. The tool can be used when you want to delete some parts and also if the deleted content wants to be resurrected. All respondents have no difficulty in doing the task and also the existing icons already show the appropriate function. In addition, 2 out of 31 respondents delete text by clicking on the text they want to delete. In the text, a trash bin icon will appear and by clicking the icon, the chosen text will be deleted or disappeared. Respondents found this feature because in the previous task respondents had tried to move text. When you want to move this, the respondent tries by clicking the text you want to move so that the respondent finds the trash bin feature. Unfortunately, one respondent did not undo deleted text using the undo button so that respondent rewrote the text that was just deleted.

*7) The Text or Content Requested to be Deleted is All Text or Content on The Screen*

In this task the scenario is similar to the previous task, it's just that the text or content requested to be deleted is all text or content on the screen. In this task, respondents are expected to use the clear all annotations button located below the eraser tool to delete all text on the screen. All respondents had no difficulty doing this task because similar tasks had been done before, only there were 6 respondents who did not use the clear all annotations tool to delete. In addition, one respondent who did not use the clear all annotations tool also did not use the undo button so that the respondent rewrote the deleted text. This also causes the respondent's task completion time to take a long time, which is 1 minute 28 seconds where respondents who use the clear all annotations tool only spend an average of 5.08 seconds.

*8) Capture Images Using Capture and Then Open The Capture Results in Whiteboard*

Respondents were asked to capture images using Capture and then open the capture results in Whiteboard. In this task, respondents were asked to capture the DTSI logo. In App Capture, an arrow-like display will appear to select the cropped area from the capture, the done button, the open in whiteboard button, and the close button. The done button appears when the user will finish the captured results. Next, an open in whiteboard button will appear and the capture results will appear in the Whiteboard App. After the image was successfully opened in Whiteboard, respondents were asked to add a little writing as a sign that the capture had been successfully opened in Whiteboard. There were slight differences in some respondents. 4 respondents captured the entire screen, 1 respondent opened Whiteboard without clicking open in whiteboard so that the capture results did not appear, and 1 respondent clicked the wrong camera instead of Capture App. Almost all respondents had no difficulty in understanding this task and managed to capture the image requested on the first try. However, some respondents captured the entire screen including the display of the website that shows the DTSI logo. Even so, the task is not a problem and respondents understand to use the Capture feature. One of the respondents also did not use the open in Whiteboard option that was already in Capture. The respondent opened the manual Whiteboard and took a picture with the insert image. Even so, the task is not a problem, the respondent is fixed on the command to display the capture results on the Whiteboard so that the process passed is by inserting images from Whiteboard and not capturing and then opening in Whiteboard. Finally, there was a mistake from respondents who mistook the camera logo on Google search image as the capture feature in question so that there was a little obstacle at the beginning of the test task. However, the rest of the respondents can carry out the task in accordance with the expected way in this study.

*9) Add More Images that Have Been Captured Earlier*

In this task, respondents are asked to add more images that have been captured earlier so that there will be two identical images on the Whiteboard. In addition, respondents were also asked to try multiuser mode which will later display two Whiteboard tools so that each side of the screen gets one image and tool. From this task, it is expected to demonstrate and illustrate the use of the Whiteboard feature, which can be used by more than one person simultaneously. However, few of the respondents were able to complete this task quickly because there was confusion about how to add the same image as the Whiteboard feature. Most respondents do not think that the way that can be done is by inserting images, because respondents do not know that the results of the capture in the previous task are automatically stored in a folder on the interactive display. As for the use of multiuser mode, there is no difficulty because the icon is quite representative although few respondents realized too late that multiuse mode was active because there was no active feature notification and the respondent's viewport did not notice that the tool feature was divided into two at the bottom of the screen, while the multiuser mode icon itself was on the top side of the screen.

*10) Task Scenario to Use A Pen for Underline Text and a Highlighter for Highlight Text in The Annotate App*

The tenth task contains a task scenario to use a pen for underline text and a highlighter for highlight text in the Annotate App. All respondents have no difficulty when working on this task, it's just that sometimes the screen does not respond and lines or highlights do not appear so respondents have to repeat movements to make lines and highlights. Similar tasks have also been done before when using a pen to write on the Whiteboard so that respondents do not have difficulty. The icons used to indicate pens and highlighters on Whiteboard and Annotate are also similar, making it easier for respondents.

*11) Scenario to Use A Highlighter and Pen But Replace and Use A Different Size*

This task contains a task scenario to use a highlighter and pen but replace and use a different size. In the previous task, respondents were only asked to use the default size. In this task, it is asked to change the size according to the one in the options. To use a pen or highlighter, the trick is to click on the pen or highlighter icon you want to use. Next to choose the size, you can click once again on the pen icon or highlighter that has been selected before. Based on the observations, one of the respondents tried to change the size

of the highlighter by holding on the color that had been selected so that the size did not appear, but the respondent immediately tried on the highlighter tool icon to change the size. While the other two respondents hold on the icon tool that will be used to resize. In addition, some respondents experienced problems that when using a pen or highlighter the line did not appear so it had to be repeated several times.

*12) Respondents are Asked to Move on to The Next Slide Without Closing The Annotate App*

In this task, respondents are asked to move on to the next slide without closing the Annotate App. The objection of this task is to show how to control the existing software opened without closing the Annotate App therefore the annotation will not be erased. Eye button on the menu will help respondents and user to perform this task. In this task, respondents are expected to use the eye button on the Annotate App. Eye button is used if the user wants to exit annotate mode and interact with apps on the screen without closing the Annotate App. Only three of the 31 respondents took a while to use this eye button. This happens because respondents think that by closing (clicking the cross) Annotate menu which leads to the closing of the menu and the loss of scratches. The rest of the respondents did not experience difficulties because the features in the Annotate menu were not too many and similar to the features on the Whiteboard so that there was one feature that was previously absent, namely the eye button.

*13) Task Scenarion to Delete Some of The Scribbles on The Screen*

This task is similar to the task when using Whiteboard App, which is to delete some of the scribbles on the screen. For this Annotate, what is removed is the annotate that has been created in the previous task. Respondents found this task easy and also the icons are the same as those in the Whiteboard App so it is not confusing. However, one of the respondents did not use the eraser tool and used the undo button to dismiss and redo to appear. This is because respondents are asked to delete the underline that has just been written, so respondents choose to use undo and redo because it is more time efficient.

*14) Respondents Are Asked to Delete All Annotate on The Screen*

In this task, respondents are asked to delete all annotate on the screen. Based on observations, all respondents can do this task without problems. This is because the task is similar to the task in the previous application so that respondents already know which tool to use.

*15) Respondents Were Asked to Slide The Annotate App*

In the last task, respondents were asked to slide the Annotate App. This Annotate App appears in the middle of the screen when the application is first opened. It becomes easier for the user to know that the application is open than to be on the sides of the screen that are likely invisible (not in the viewport). But because of this, the application sometimes covers the part of the screen that you want to annotate so this task is tested. On the application display, there is a pink area at the bottom of the menu that can be used to slide Annotate easily. Based on observations, 16 respondents used this pink area to move Annotate. While the other 15 respondents used a white area on the edge of the Annotate outside the tool area to slide. However, because this white area is also the tool buttons in Annotate, some respondents cannot move Annotate in one move. Placing your finger on the Annotate menu must be precise outside the circle area of the tool so that Annotate Menu can be moved. While in the pink area mentioned above, the touch area is more flexible because this area is wider so high precision is not needed.

### *C. System Usability Scale (SUS) Questionnaire Result*

Respondents will answer on a likert scale of 1 to 5 where 1 means strongly disagree and 5 is strongly agree. Table 5 shows the total score of SUS.

According to Table 5 about the total score and average score of SUS of interactive display, the average score is 66,6129032 which categorized as marginal acceptable range or OK category. This shows that interactive displays have not been well received so suggestions are needed in utilizing interactive displays so that the reusability of the tool is higher.

### *D. Recommendations*

Recommendations will be presented to create interactive classes and can increase the reusability of using interactive displays in lectures. After observing trials using interactive displays and interviewing respondents related to the use of interactive displays, here are the recommendation points that can be submitted (Figure 1).

*1) Utilization of Screen Share feature in group discussions in class*

The Screen Share feature on Promethean interactive displays can be used like projectors in general. But the difference is that with the Screen Share feature, the laptop connection with the screen can be connected without using a cable so that students in class can display the results of the discussion in the form of a presentation without the need to connect with a cable. In addition, the Screen Share feature can allow up to a maximum of 4 devices to appear on the display simultaneously, so that the results of discussions from 4 groups can be displayed simultaneously and compared. The disadvantage of this feature is that the resolution is still not good for connecting laptops and displays and adjustments must be made such as the Wi-Fi network used by the laptop and display must be the same in order to connect.

Another thing that can be used from the Screen Share feature is the collaboration of all classes to create a certain design such as a prototype or flowchart. The trick is to use a design service provider website that can be directly opened through Google Chrome on the display. The website can give permission for collaborative activities so that all students can join the website. From here, lecturers can monitor directly from the display screen the collaboration process in design activities.

*2) Utilization of Whiteboard feature for more interactive classroom gaming activities*

The proposal to use the Whiteboard feature in class activities can be done by doing a game to answer questions by racing two groups. The scenario that can be created is, in one class divided into two groups where each group is lined up in front of the display. Then, questions will be given by lecturers related to the course. Both groups will compete by answering on display. The display will open the Whiteboard feature where students can write answers. On Whiteboard

there is a feature that can divide the screen into two, namely multi user mode. When multi-user mode is activated, there is a line that divides the screen in half so that each group can write the answer. In addition, tools such as pen, highlighter, and eraser are available on each side of the screen so that groups will not disturb each other.

## V. CONCLUSION

These are the conclusions that can be obtained after conducting observation and research: (1) In this study, usability testing was conducted by 31 respondents consisting of 30 students and 1 DTSI lecturer. User experience testing is conducted to see how respondents or users use interactive displays and their perceptions of the technology. The test carried out is trying to use the Screen Share, Whiteboard, and Annotate features. In the Screen Share feature, respondents were asked to do 2 tasks, in the Whiteboard feature they did 7 tasks, and in the Annotate feature they did 6 tasks. In addition, interviews were also conducted using the Retrospective Think Aloud (RTA) method where respondents were asked to submit their responses after using interactive displays. RTA was chosen because it did not interfere with respondents during the trial. The interview is also divided into two parts, the first part is done at the end of each task and the second part is done after all tasks are completed to ask about the more general experience of using interactive displays. Finally, respondents were also asked to fill out the SUS questionnaire to support the analysis. (2) Usability analysis is carried out by analysing the activities of all respondents on each task. In addition, the SUS questionnaire is also calculated to see the score as well as its validity and reliability. Although the results of the SUS questionnaire are categorized as invalid and inconsistent, the analysis of respondents' answers as well as the calculation of validity tests and reliability tests are still included as supporting the analysis. From testing activities, respondents do not feel too difficult in doing the task, since it is the first time trying so that there are some things that are confused, especially related to the functions of existing tools. However, according to respondents, most of the tools are not difficult because they are similar to tools on other devices or software that have similar features, such as Screen Share which is similar to the use of projector screens and Zoom applications, Whiteboard which is similar to drawing software such as Adobe Photoshop and CorelDraw, and Annotate which is similar to the annotate feature in the Zoom application. Other features that still feel new to respondents are how to connect the laptop to the screen without using cables in Screen Share, how multiuser mode can be activated on Whiteboard, and eye button on Annotate which can allow users to move the screen without deleting scribbles and without closing the Annotate menu. (3) Recommendations that can be given related to the use of features in interactive in supporting lecture activities are such as the use of Screen Share as a means of presentation that is easier and less time-consuming. In addition, the use of Whiteboard in supporting more interactive classroom activities by using group sparring games as a learning tool.

## REFERENCES

[1] M. Johnson and D. Majewska, *Formal, Non-Formal, and Informal Learning: What are They, and How Can We Research Them?*, 1st ed. United Kingdom: Cambridge University Press, 2022. [Online]. Available: https://www.cambridge.org/. ISSN: ED626005.

[2] D. M. Broussard, Y. Rahman, A. K. Kulshreshth, and C. W. Borst, "An Interface for Enhanced Teacher Awareness of Student Actions and Attention in a VR Classroom," in *2021 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, 2021, pp. 284–290. doi: 10.1109/VRW52623.2021.00058.

[3] J. Brooke, *SUS-A Quick and Dirty Usability Scale*, 1st ed., vol. 189, no. 194. London: CRC Press, 1996. ISSN: 9780429157011.