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The Development of Interactive Games for Covid-19 Prevention Using Indonesian Health Protocols

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ABSTRACT

COVID-19 has become a virus spreading quickly across the world. The government of Indonesia also immediately adjusted the conditions to minimize the spread of the COVID-19 virus by implementing the health protocols 5M namely, wearing a mask, washing hands, keeping distance, avoiding crowds, and reducing mobility. With the advancement of technology, games can be used as educational media to support users learning processes and increase their knowledge. Therefore, we conducted a study using the learning support media, namely interactive games based on a personal computer platform with the Windows operating system to help the users understand the prevention of the COVID-19 virus by implementing health protocols. This study proposes using a structure for the iterative cycle process called the ADDIE model framework and using the Unity game engine for its game development tools. To measure the feasibility of interactive games as educational media, we use the System Usability Scale method. Based on the application testing of 50 respondents, interactive games get a score of 90 on a scale that is acceptable. The results also indicate that interactive games as educational media will improve the users learning process and motivation about implementing the health protocols.

Keywords: *COVID-19, health protocols 5M, interactive games, Unity, ADDIE model, System Usability Scale*

I. INTRODUCTION

The COVID-19 virus caused by SARS CoV-2 has been rapidly spreading worldwide, causing a global pandemic [1]. Transmission of the COVID-19 virus is caused by droplets of fluid due to close contact with an infected person through the mouth or nose at a distance of 1.4 to 2.5 meters [2]. The government of Indonesia also immediately adjusts conditions to minimize the spread of the COVID-19 virus by implementing a clean and healthy lifestyle [3]. A clean and healthy lifestyle is applied in the guidelines for prevention and control of the COVID-19 virus by implementing the health protocols 5M, including wearing a mask,

washing hands, keeping distance, avoiding crowds, and reducing mobility [4]. However, Indonesian people currently have not fully appealed to government regulations in terms of implementing the health protocols 5M to prevent the spread of the COVID-19 virus [5]. Studies by Pinasti [6] showed that 52.3% and 56.9% of 130 respondents with an average age of 18-50 years did not wash their hands before eating and did not bring hand sanitizer when traveling as a form of self-protection. Whereas maintaining the hygiene of both hands with proper handwashing interventions can break the transmission cycle and reduce the risk of spreading the virus between 6% to 44% [7]. The use of masks as face shields is also significant to prevent the spread of the virus. Through the proper use of masks as face shields, the process of spreading the COVID-19 virus can also be controlled [8].

Accordingly, the government of Indonesia is trying to increase public interest to minimize the spread of the COVID-19 virus by implementing health protocols 5M [9]. However, the important question is whether the embedding of learning strategies to socialize the implementation of the health protocols. To achieve this objective, we conducted a study using the learning support facilities and media around us, namely interactive games [10]. Games have evolved into a significant electronic entertainment business that engages a diverse spectrum of players worldwide due to their accessibility through various platforms [11]. Games also can be used as educational media by utilizing technology to support users learning processes and increase their knowledge such as theoretical material [12]. This statement is evidenced by previous studies [13] that have been done built games based on Virtual Reality (VR) with three-dimensional animation to measure social distancing and wearing a mask still necessary to prevent the spread of the COVID-19 virus. In this article, the game's character must decide on two objectives, stay healthy or contain it. The goal of the game's mission is to keep the character stay healthy and if the character is infected, their goal is not to infect other agents but to keep their risk of the COVID-19 virus infection low with a distance between 1.5 meters through a head-mounted display. Other studies conducted by Sarudin and Aziz [14] have been done built games based on Augmented Reality (AR) to make people aware of the COVID-19 virus. This article showed that

the test results of the application to 51 respondents are very useful for education and informing people with a percentage of 48% strongly agreed and a percentage of 45% agreed.

Based on the problems that occurred, this study is conducted to build educational media through interactive games to provide users knowledge about implementing the health protocols 5M is still necessary to prevent the spread of the COVID-19 virus intended for teens 13+ years old based on the personal computer platform with Windows operating system. With these interactive games that we developed based on personal computers, users can easily install and play games in their homes due to the government adjusting the condition called "stay at home" to reduce the spread of the COVID-19 virus [15]. In the development of interactive games, there are the health protocols 5M menu materials containing five animation videos in this game. There is also a game mission with a three-dimensional visualization that must be completed to test users' understanding of the health protocols of the 5M material delivered. Three-dimensional animation modifies an object to make it look like a reflection of reality and higher than reality. Three-dimensional animation also can be an effective tool for education and training simulation [16]. In creating these interactive games, we use the Unity game engine with the C# (c-sharp) programming language [17].

II. METHODOLOGY

This section discusses the employed research methods for creating interactive games by utilizing one of the research and development methods, the ADDIE model [18]. In this study, the step ended in evaluation. To measure the feasibility of interactive games as educational media, we use the System Usability Scale method [19]. Figure 1 shows the ADDIE model which consists of five phases.
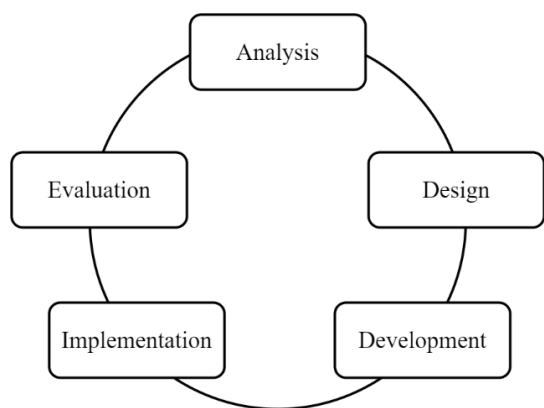
Figure 1. ADDIE model framework

2.1 Analysis

The first step is analysis. At this stage, we are conducting a literature study to analyze previous research relevant to the topics of this study. We found the previous study that has been done [13], [14], and then we developed a novelty application for this study, which is to prevent the COVID-19 virus by implementing the health protocols 5M using interactive games as an educational media intended for teenagers 13+ years old. The required data obtained from [4] was then used as game material regarding the health protocols 5M. It also determines what hardware platform and operating system to apply to these interactive games. The hardware used in this game is based on the personal computer platform with Windows operating system.

2.2 Design

The second step is designing. The usability of designing the current state of the user interface of interactive games based on the personal computer platform with Windows operating system to show the steps of the game being built by developers. At this step, we divided it into two types of design: user interface game design which adopts game storyboard creation, and screen flow creation which includes a menu of material and a gameplay menu to specifically define the direction of the interactive games created.

2.3 Development

The third step is development. This involves making a user interface design with a High-fidelity display, which means there is a visible development in the visual color of our interactive games, next is giving the commands (code programs) to each asset and character

used to run according to its function, and the last step is adding animation effects (e.g., pick-up effects, get hit effects, confetti effects, checkpoints effects). The result of this stage is realized in the application that is ready to be implemented.

2.4 Implementation

The fourth step is implementation, which is the launch phase of the application that has been developed in the previous stage. The interactive games have been developed based on the personal computer platform with Windows operating system. The flow of interactive games from the stage the game was built into the stage of the game that the users have played is displayed in Figure 2.

Figure 2. Output application of interactive games

2.5 Evaluation

To find out if the application built is feasible to be applied according to the needs and objectives expected by implementing the health protocols 5M, we used questionnaires to assess the feasibility of interactive games and whether they were worth applying to users. Therefore, the concept of user experience constitutes one of the significant factors in determining the game success rate. Users will not depend on a particular mode of emotion but encompass a wide variety of emotions which is the game player feels fear, happiness, excitement, relief, and pride to contribute to the game player experience being developed. There is a 10 SUS questionnaire given to users using Google Forms with two statements at the testing phase. Positive statements are contained in numbers 1,3,5,7,9 (odd) and negative statements are contained in numbers 2,4,6,8,10 (even). In the testing phase involving Indonesian people, we have translated the SUS questionnaire into Bahasa Indonesia to make it easier to interact with users. Each item of our questionnaire was rated on a five-point Likert scale: strongly disagree, disagree, less disagree, agree, and strongly agree [20].

If the questionnaire data collection process is completed, the data from each questionnaire will be entered into Microsoft

Excel to be processed. Based on the results of the questionnaire items, the overall score of each respondent is calculated using Equation 1.

$$\bar{x} = \frac{\Sigma x}{n} \qquad (1)$$

Where $\bar{x}$ is an average score, Σx is the sum of the results on each odd number question is subtracted from the user score minus 1 (x-1), on each even number question subtracted the results from 5 minus the user score (5-x), and n is the number of respondents.

III. RESULTS AND DISCUSSION

In this section, we will explain the design results, which consist of screen flow and storyboard game design, the results of the development phase of interactive games, which consist of user interface and gameplay menu, and the final stage is the application testing phase to measure the feasibility of interactive games as educational media.

3.1 Design
3.1.1 Screen flow Game

The screen flow is used as a reference to show the step menu in designing the interfaces of our interactive games. Figure 3 shows the structure chart of the material menu of our interactive games which consists of five menus and Figure 4 shows the screen flow of the structure menu of interactive games with a flowchart structure.
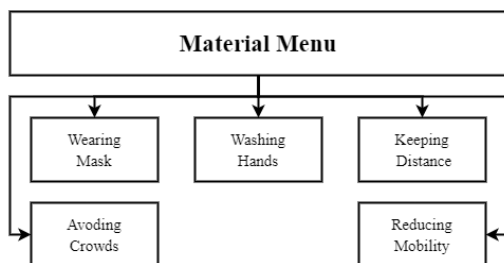

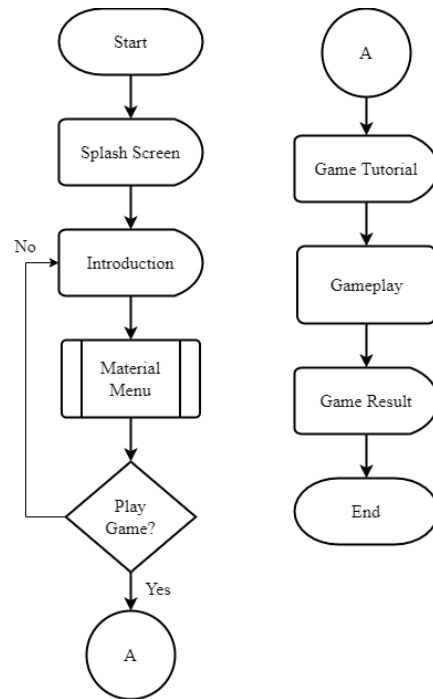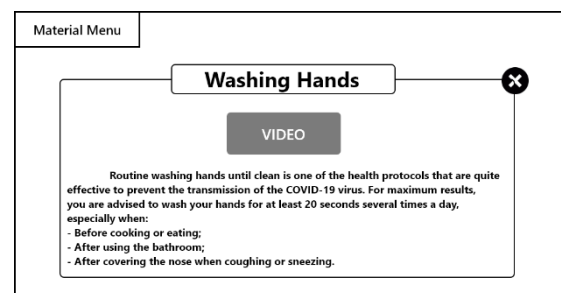Figure 3. Material menu of interactive games

Figure 4. Structure menu of interactive games
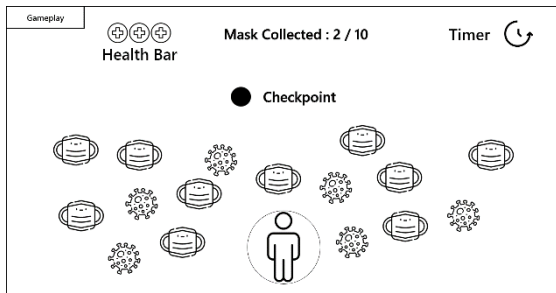
3.1.2 Storyboard Game Design

The creation of storyboards is intended to identify the need for story ideas in the form of sketch images arranged in sequence to make it easier for users to know the plot of the interactive games.

(a)

(b)

(c)

(d)

Figure 5. Illustrations of interactive games

Figure 5 shows the illustrations of interactive games that will be developed during the development phase. Figure 5(a) displays the theory of each material menu, washing hands. Figure 5(b) displays the animation video on keeping a distance from other people. Figure 5(c) displays our game mission to collect the masks and avoid viruses. Figure 5(d) is the result of the game mission.

3.2 Development
3.2.1 User Interface Results

(a)

(b)

(c)

(d)

Figure 6. High-fidelity interface of interactive games

Figure 6 shows the interface of our interactive games with a High-fidelity display. We have translated this application into English. Figure 6(a) shows the main menu of interactive games, containing two menus: the play menu and the material menu. Figure 6(b) shows the material menu of health protocols 5M. There are five menus: wearing masks, washing hands, keeping distance, avoiding crowds, and reducing mobility. Figure 6(c) shows one of each material menu, namely the washing hand's animation video, and Figure 6(d) shows the game view of interactive games.

3.2.2 Gameplay Menu

(a)

(b)

(c)

(d)

Figure 7. Game mission of interactive games

Figure 7 shows the game mission of the interactive games. The main character in the game will play in single-player mode with a three-dimensional visualization. Figure 7(a) shows the game tutorial before the game player starts the game, the keyboard function used when playing, and the game mission that must be completed, namely collecting masks and avoiding viruses.

Figure 7(b) shows the game mission where the character is directed to collect masks in the game. The masks will automatically increase if the character takes every existing mask. The total number of masks that must be collected in the game is 10. There are also pick-up effects in the form of stars if the character gets a mask.

Figure 7(c) shows that the characters are directed to avoid the virus. If exposed to the virus, the character health bar will decrease. There are three health bars given to the character while playing, if the character is exposed to the virus three times, the game mission will fail, and the game player is directed to click "PLAY AGAIN" on the gameplay menu. There are also invincibility flash effects if the character is exposed to the virus.

Figure 7(d) shows the game result of the interactive games. The step to reach the checkpoint is that the character must collect every mask to get the results of the game mission. If the game player collects fewer than

five masks, they only get one star. If the game player collects more than five masks, they get two stars, and if the game player collects more than seven masks, then the game player gets three stars. There are also confetti effects on characters who have completed the game.

3.3 Application Testing

Table 1 shows the application testing of 50 respondents with an average age of 14 to 21 years. The collected data from each answer the respondent will be searched using Equation 1 to get the value of acceptability ranges of the System Usability Scale method.

Table 1. Questionnaire Results

No	Statement	Total Answer				
		1	2	3	4	5
1.	In my opinion, these interactive games are suitable for COVID-19 prevention education.	0	0	1	31	18
2.	In my opinion, the health protocols 5M material given on the interactive games it's unclear.	49	1	0	0	0
3.	In my opinion, user will quickly understand the material delivered in these interactive games.	0	0	0	26	24
4.	I need support from technical person to use these interactive games.	23	23	4	0	0
5.	I feel happy when completing the game mission with the fastest time.	0	0	0	0	50
6.	I feel there is a mismatch in these interactive games (bug/error).	49	1	0	0	0

		1	2	3	4	5
7.	In my opinion, the gameplay of interactive games it's not complicated to play.	0	0	10	30	10
8.	In my opinion, interactive games are very complicated to use.	24	26	0	0	0
9.	These Interactive games can motivate people to implement the health protocols 5M.	0	0	2	30	18
10.	I need to learn a lot of things about the health protocols material before using these interactive games.	44	6	0	0	0

Table 2. Result the data has been processed

Value Data				Total Sub	Overall Scores
1	2	3	4		
0	1	31	18	167	418
0	0	1	49	199	498
0	0	26	24	174	435
0	4	23	23	169	423
0	0	0	50	200	500
0	0	1	49	199	498
0	10	30	10	150	375
0	0	26	24	174	435
0	2	30	18	166	415
0	0	6	44	194	485
	Total				4480

The total amount of data in Table 1 will be processed on each odd number subtracted from the user score minus 1 (x-1) and on each even number, the number 5 minus the user score (5-x), which then shows the largest answer scale is 4. To find out the overall scores in Table 2, each total sub-number is multiplied by 2.5 and then shows the highest results on each questionnaire.

The last step is to determine the average value of the answer of all respondents, with overall scores (4480) divided by the total number of respondents (50). Accordingly, the application testing results are shown in Figure

8. Interactive games received a score of 90 with an acceptability range is "acceptable". Based on these results, interactive games are feasible to be applied to educational media.

Figure 8. SUS Interpretation Scale

IV. CONCLUSION

This study proposes an application with interactive games as educational media using an iterative process structure ADDIE model framework to help the users understand the prevention of the COVID-19 virus by implementing the health protocols 5M, namely wearing a mask, washing hands, keeping distance, avoiding crowds, and reducing mobility. When games are equipped as educational media with appropriate learning strategies, it can be indicated that games may improve user's learning process and motivation through the material given. With these interactive games, we hope that more people will gain awareness and knowledge of the COVID-19 virus by implementing health protocols.

The adaptation of future works will be developed based on information regarding the guidelines for the prevention and control of the COVID-19 virus to provide additional direction for assessing the overall usability of interactive games. By integrating usability guidelines to prevent and control the COVID-19 virus, this application will be developed further to a comprehensive platform such as a mobile application on the Android and Apple iOS development practices.

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