The Development of 3D Survival Simulation Game for Identifying Safe Food and Water in Borneo Forest

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Abstract

For adventures who like to explore the forest with diverse type of flora, such as Borneo forest, being lost and have limited supply of food and water become one of the biggest threats for survival. Therefore, it is important to know how to identify food and water that is safe for consumption. Unfortunately, the learning media for survival skills are still heavy on verbal approach, so there is a need for a more practical and visual learning media. To overcome the problem, this research was aimed to develop a survival simulation game that teach the player how to identify safe food and water in Borneo forest. The game was developed in six steps based on Luther's steps of authoring multimedia. At the end of the development process, the feasibility of the game as learning media is tested using pre-test and post-test method. Statistical analysis using paired t-test showed that the post-test result (M=77.33, SD=5.37) was significantly higher than the pre-test result (M=56.67, SD=8.24)); t(29)=18.49, p < 0.001. This indicates that the game is feasible in teaching the knowledge to the player. In the future, this game can be an alternative and practical solution for teaching survival skill.

Keywords: Simulation Game, Serious Same, Learning Media, Survival Skill, Identifying safe food and water

1. Introduction

Nowadays, exploring forest or hiking mountain is a popular trend. It is not only enjoyed by exclusive community like environmental, mountaineering, or adventure community, but also by a lot of ordinary people. One of the reasons why exploring natures become a trend is that it allows people to enjoy the beauty of the view and create special memory of that place, either alone or with group.

Borneo Island is one of five big islands in Indonesia. Among the cluster of Sunda Island, it has the richest flora of approximately 10.000-15.000 varieties of plant [1]. This makes Borneo island one of the centers of flora in the world, like Papua Island or South America. In addition, it also has many mountain and hills with thick and natural rainforest. The varieties of the flora and natural beauty of the island make it a suitable place for adventure. However, this can have its downside. The mountain and hills can be difficult to hike, and the thick rainforest can potentially mislead the adventurer off the track. Although the adventurer can find lots of plant in the forest while being lost, the vast amount of flora can make it difficult to identify toxic food and water among them. Therefore, every adventurer must have survival skill beforehand, especially skill related to distinguishing edible food and toxic food because of the various plants that inhabit Borneo forest.

Survival skill can be learned from organization or community that specialize on it. For example, in school or university, all students who belongs to environmental and adventure club must learn survival skill before they can join any club's outbound activity. The lessons are usually taught by the upperclassmen or expert. Based on our observation in university club, survival skill is mostly taught verbally with limited practical session. This is due to

insufficient learning material to demonstrate the skill directly. In addition, material for survival skill in the Internet, especially material about identifying safe food and water, is very scarce.

This limitation makes learning survival skill, that is essential for any adventurer, very difficult. Teaching survival skill verbally lacks visual component to be transferred to the learner, which make learning process more difficult [2] [3]. Lack of visual component force the novice adventurers to depend on their imagination to understand the material, which is unreliable as they have no prior knowledge of the material. In addition, scarce learning material in the Internet make it difficult for them to validate their imagination. Compounded with the limited practical session, they can be unprepared for the real situation, especially if it is different from their expectation.

In the context of learning the skill to identify safe food and water, if the destination has vast amount of plant varieties, it will aggravate the problem. For example, the aforementioned Borneo Island with more than 10.000 variety of plant. In this context, it will be impractical to ask the novice adventurers to depend on their imagination during learning process. Therefore, there is a need for a more practical and visual learning media to help teaching survival skill to novice adventurers, especially the skill to identify safe food and water.

Nowadays, with the emergence of game as industry [4], game has been recognized as a potential media to promote learning [5] [6]. Game that is not intended solely for entertainment is called serious game [7]. Serious game has a broad utility spectrum for learning process [8] [9], and it has been implemented in many distinct domains, from school education to military training, health care, and management [7] [10]. The positive effect of game as learning tool can be highly found when the content is targeted specifically and the purpose is defined precisely [8].

One type of serious game is simulation game which represent system with rules that similar to the real world [11]. Using visualized simulation, authentic problem solving, and instant feedback, game can help creates realistic framework for understanding the situation and allow basic active learning [12] [13]. Simulation game also allow safe environment for the player so that they can experiment without considering the risk and the consequences of failure [5], [14]. Simulation game has also been proven to be feasible [15], pleasant [16] [17] [18], and effective [19] [20] [21] as learning media. It can also increase the motivation [22] [23] [24] and the knowledge of the player [16] [17].

With the advantage provided by simulation game, this research focus on developing a survival simulation game to teach the player how to identify food and water in Borneo Island. The game can be an alternative solution for teaching survival skill, especially when practical session is the preferred method of teaching. For the organization of this paper, first, the method used to develop the serious game will be elaborated, including the design process. Then, the feasibility testing process is explained, including the result and the analysis. Finally, the findings of this paper will be summed up in the conclusion and the future works based on current research will be explained.

2. Method

The research followed Luther's steps of authoring multimedia [25] which consists of 6 stages: Concept, Design, Material Collecting, Assembly and Production, Testing, and Distribution. However, this research only implemented the first 5 stages and did not implement the distribution stage. The following sections explain how each stage was approached by this research.

2.1. Concept

In this stage, the research decided on the learning material, teaching method, gameplay, setting, and plot that will be implemented in the application. First step of creating the concept was to decide on learning material. The expected learning outcome for the player after playing this game is to have the practical knowledge on how to identify safe food and water in Borneo Island. Based on that, the

research used material from a chapter of an U.S. Army manual book [26] related to sorting food and water. This book was chosen because it is more well-organized and detailed. From this book, two materials are chosen to be implemented. The first material related to the characteristic of plant that should be avoided, and the second material related to irritation testing method to identify safe food. Aside from the book, the research also conducted interviews with senior members of environmental and adventure activity in several universities. From interview result, two materials are added to be implemented. The materials related to characteristic of safe water and usage of animal as sign for safe food and water

From these materials, the second step was to decided on how to deliver the materials to the player. Since the expected learning outcome related to practical knowledge, the research decided on using simulation games and provided a safe environment for player to experiment in identifying, choosing, and eat food or drink water. The environment and the game feedback were created as real as possible to help players get used to the real situation. From the game feedback, the player would learn how to idenfity safe food and water while also learn the consequences of eating or drinking toxic food or water.

The third step was to translate the learning material and teaching method into the gameplay, plot, and setting. The main setting of the game is Borneo Island. The main plot of the game tells the story of how the player get lost together with and old man in the forest and both of them need to survive while waiting for help. In the game, the player had to find food or water to survive. Players must keep their health, energy, and fluids level above threshold. Energy level can be increased by eating food and fluid levels can be increased by drinking liquids. The player must avoid toxic food and liquids as it will decrease healt. To avoid those things, the player can see detail image of food or water and he/she can also perform a variety of tests against the food and drinks. The player can navigate the character using the keyboard and mouse.

2.2. Design

In this stage, the game mission, storyboard, flowchart, navigation structure, and game interface were designed. In addition, all the material needed for the game were listed and rough sketch for each material were created. The game was designed to have 4 missions with increasing complexity and difficulty. First mission was designed to teach player the basic mechanic of the game and how to identify safe water. Then, the second mission was designed to teach player how to identify safe food based on only the plant characteristic. Afterwards the third mission focus on teaching player how to identify safe food based on irritation testing method. Finally, the last mission focus on teaching player on how to identify safe food by combining previous method with more complex method such as using animal, smelling, etc.
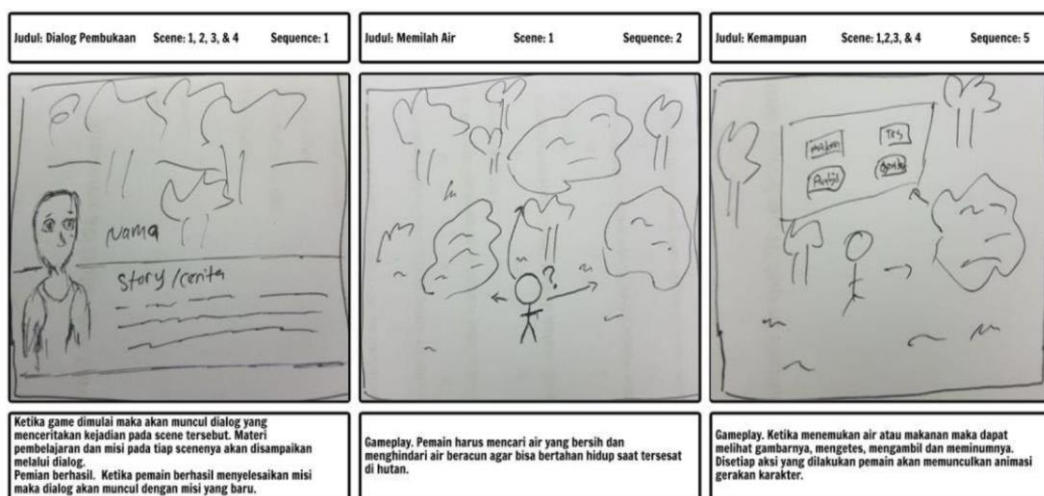

Figure 1. Example of Game Storyboard (in Bahasa Indonesia)

From the mission, storyboard to visualize the gameplay was created. This storyboard became the guide on how the gameplay, game environment, and game material supposed to look. Figure 1 shows part of the storyboard (in Bahasa Indonesia)
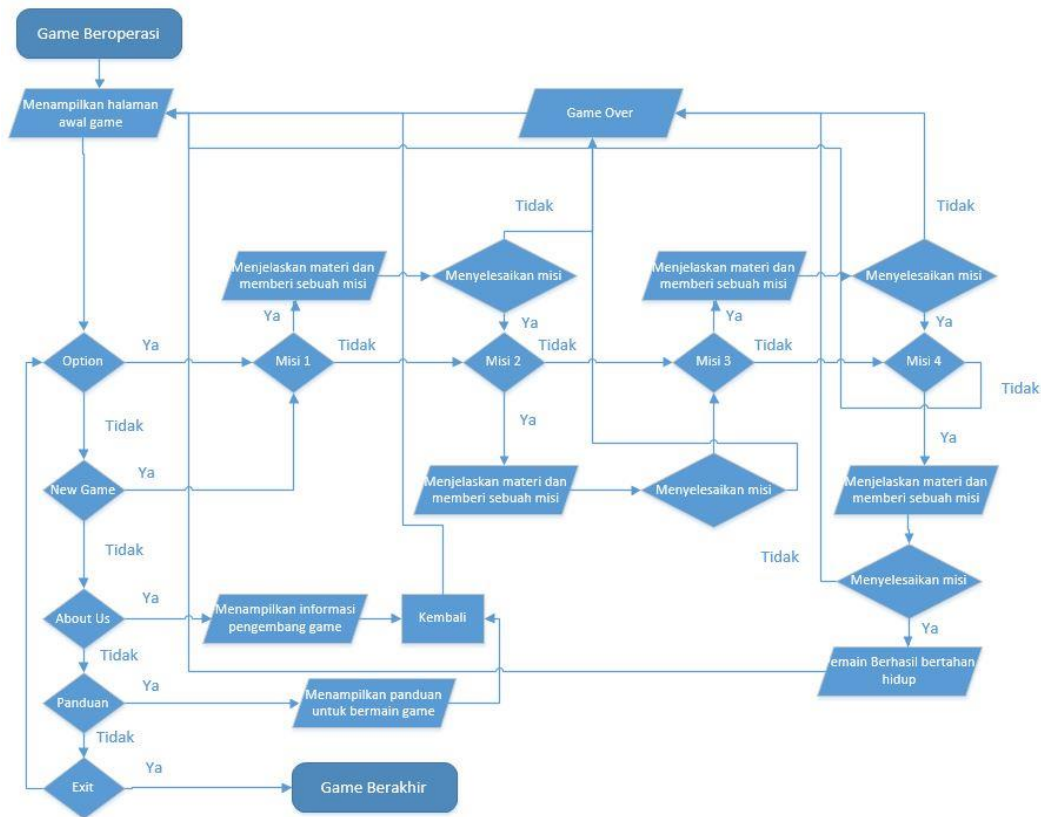

Figure 2. Game's Main Flowchart (in Bahasa Indonesia)

Afterwards the flowcharts of the game were created to visualize the logical process of the system which will guide the game development process in the Assembly stage. Figure 2 shows the main flowchart of the game (in Bahasa Indonesia).

2.3. Material Collecting

In this stage, images, 3D objects with textures, 3D characters, audio, animation were collected and/or created. These materials include terrain, tree, plant, fruit, texture, old man character, etc. Most 3D assets were collected from Unity Assets Store web (https://assetstore.unity.com/). Any necessary modifications of assets were carried out using Blender as 3D modeling tool set (https://www.blender.org/). These materials would be implemented within the game in the next stage.

2.4. Assembly

In this stage, the game was developed based on design, storyboard, flowchart, and navigation structure created in stage 2 (Design stage). This stage also implemented the material collected in stage 3 (Material Collection stage). The game was developed using Unity as Game Engine and Visual Studio as source code editor. Figure 3 and 4 show samples of the game.

Figure 3. Dialog with The Old Man. The Old Man Task is to Give Mission to Player

Figure 4. Game Interface

2.5. Testing

In this stage, the testing process was conducted to investigate the feasibility of the game as learning media. Specifically, the testing was aimed to investigate if the game can increase the player's knowledge on how to identify safe food and water. This stage was approached using pre-test and post-test method in which the player's knowledge are compared before and immediately after playing the game. This research was not focused on whether the player retain knowledge after some time has passed since playing the game.

The player's knowledge on how to identify safe food and water is acquired using a questionnaire comprised of 20 multiple choice type questions. All the questions were about the learning materials that were taught by the game. The questions in the pre-test and post-test were similar. However, in order to avoid carry-over effect, the order of the questions was different.

The participant of the testing process was aimed at individuals ranged from 17-40 years old. Based on our interview and observation, these individuals represent the age range of people who enjoy adventure or is a part of environmental and adventure club. Therefore, they appropriately represent the target user of the game. Participant were recruited using non-probabilistic method of purposeful sampling to ensure that the recruited participant correspond to our target user. In the end, 30 participants were recruited (M = 21,77, SD = 1,07).

The procedure of the testing process was as follows:
1. The experimenter introduced the game to the participants and showed them how to play the game
2. Participants were asked to answer the pre-test questionnaire
3. Participants played the games for 30 minutes. During this moment, if participants had any difficulty on how to play the game (e.g. the function of the buttons, the meaning of player's

HUD), the experimenter would guide them. However, the experiment would never guide the participants on how to finish the mission.
4. After 30 minutes, participants immediately were asked to answer the post-test questionnaire.

3. Result

After the testing process, participants pre-test and post-test score were calculated with minimum score of 0 and maximum score of 100. The pre-test score average was 56,67 (SD = 8,24) and the post-test score average was 77,33 (SD = 5,37). Clearly, there is an increase in score which indicates that participants' knowledge was increased after playing the game. Further analysis using paired sample t-test with 95% confidence interval showed that the difference is significant (t = 18.49, p < 0.001). Based on these results, it can be concluded that the game is feasible in teaching the knowledge on how to identify safe food and water.

Although the feasibility of the game to increase player knowledge has been proven, this result should be inferred cautiously to avoid generalization of the game's capability. First, the game only investigated if the player's knowledge increased after playing it. However, the research never investigated if the player can transfer their knowledge into practical skill. Therefore, a further investigation in this area is needed. Second, the game should not be inferred as superior to the aforementioned verbal method. A comparative study of both method in term of transfer knowledge effectiveness need to be conducted to reach a more valid conclusion. Third, other aspect of learning outcome such as material retention or motivation were also not investigated in this research. However, this research is a step forward toward using a survival simulation games as an alternative learning media for survival skill.

4. Conclusion

This research aimed to provide a more practical approach in teaching survival skill, especially the skill to identify safe food and water. Because of that, a survival simulation game was developed. The game provides player with safe environment that enable him/her to experiment in identifying, choosing, and eat food or drink water. The game teaches player the techniques to identify safe food and water. In addition, using the game feedback, the game also teaches the consequence of eating or drinking toxic food or water. Feasibility testing conducted at the end of the development process showed that the game was capable for delivering the knowledge to the player. This research suggest that future research can investigate other aspect of the outcome (e.g. practical skill, retention, motivation) or compare the game with verbal method in transfer knowledge effectiveness. In addition, the promising result of this research open the possibility of developing other survival simulation game that deliver different learning material to the player. Hopefully, in the future, survival simulation game can be an alternative and practical solution for teaching survival skill

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