

Interactive Game Based Self-study Package on First Aid Procedure Training

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Abstract: *There are numerous dangerous illnesses nowadays that, with prompt and effective first aid, can be treated to avoid death, such as stroke. The accurate understanding of first aid, however, has not received much attention. It is challenging to comprehend because of how complicated the steps of first aid procedure are. Therefore, our project team developed a first aid game. It is important to comprehend and support stroke victims. The purpose of this study was to develop a stroke first aid game and provide advice on stroke first aid to the public. This game was developed as 3D interactive games by designing games that can simulate real situations, so that players can enjoy the game and experience its reality. To collect information about the players’ satisfaction with the game, questionnaires were used gathering information from 30 individuals with the ages range of 15 to 25 years old and they were tested before and after playing the game. The findings indicated that players have much more knowledge and satisfaction from playing games. In the opinion of some players, the game could be improved to give players more challenge and excitement..*

Keywords: *First Aid, Stroke, Interactive game*

1. Introduction

In Thailand, strokes are the second ranking cause of death and disability in persons who suffer from it. Only a few people are aware of this kind of illness. Two main types of strokes can normally be found in Thai population. One is an Ischemic stroke, and another is a Hemorrhagic stroke. Approximately 80% of all stroke cases fall within a category of Ischemic stroke. The rest 20% belong to Hemorrhagic stroke. The most common Ischemic type is an obstruction of blood flow in our body caused by a blood clot or fatty deposits and cholesterol in the bloodstream resulting in a blockage of an artery in the brain. The accumulation of cholesterol in the arterial wall makes the blood vessel narrow and less flexibility, which is in turn inefficient transport of blood oxygen to the brain. There are uncontrollable risk factors which increase the risk of stroke such as age, gender, high blood pressure, high cholesterol, heart disease and diabetes. The symptoms of stroke can occur a few times before an actual stroke known as simi-strokes. Signs and symptoms are vital that the immediate medical attention is needful.

First aid is crucial for stroke patients in case of sudden warning sign appearing. Then a full-blown stroke can occur within 24 hours after the initial sign. The main goal of this proposed work is to assure that the emergency help on stroke patients will be correctly exercised during a nick of time to save a patient from severe and potentially life-threatening. Therefore, the interactive game-based first aid learning package has been

designed, created, and evaluated for alternative educational training to learn the correct procedure and techniques of first aid practice when emergency assistance is needed to immediately response. The designed learning package can also provide training instructions of how to operate the first aid assistance in stroke patients. There are various educational resources available for first aid training, including videos, posters, infographics etc. These resources offer mainly theoretical information toward trainees without interactive feedback. Also, there are no viable media to let trainees deal with the actual circumstances during a training period. The competency evaluation made on trainees after finishing a first aid training is another mandatory to the successful training and improving related learning materials and necessarily required skills into training program.

The number of people who access all kinds of games continues increasing, which means games becoming a part of our daily activity in life. Most people enjoy playing games with personal reasons rather than just enjoyment. This kind of leisure activity can serve as a training simulation, a teaching aid, and skill training development. Players can easily engage with the game based on selecting their own favorite gram from a variety of available games. Therefore, games are another alternative that can be used for a purpose of educational matter and research study. It can be adopted as another teaching technique that encourages people to be more interested in learning and motivated to participate in the learning process under an exciting and challenging atmosphere. Moreover, game-based learning helps students motivated in applying their abilities and pertinent knowledge in game challenges. It encourages students not to be discouraged by the obstacles they encounter in games that they participate in [1].

In this paper, we present how an interactive game related first aid assistance procedure in case of stroke patients has been developed to improve the awareness of risk factors from stroke and comprehension of this illness in terms of risk factors, symptom, diagnosis, treatment and how to take care of stroke patients and first aid. By replicating the incident in a setting where it might happen, our computer-based game will first let a player to visually observe the symptoms of a stroke. The circumstances can be changed after the player's decisions have been made. The way the player wants the story to conclude will determine the game's ending. The resultant measures on players' satisfactory opinion toward game, content of story, quality in game designs, and post knowledge after playing game are collected and statistically analyzed, discussed, and concluded in paper.

The focus of stroke related first aid games through interactive and narrative games can enhance the player's cognition. In addition, there is a simulation of various important symptoms of stroke illness and all explanation related to stroke and its symptoms given as well. The sections presented in this paper are organized into the following structure. Introduction starts with the first section. Background and approach are presented in sections II and III. Section IV shows methodology and is followed by Result and Discussion located in section V. Conclusion is finally presented in section VI.

2. Background

In this section a brief overview of two main related materials to the proposed work, which are interactive game theory and first-aid for stroke patients, is provided

2.1. Interactive game theory

Games are not only played for the enjoyment and entertainment, but they can also simulate the situations in our life and used as training simulation to gain experiences and improve our required knowledge to support our decision on solving the urgent circumstances we are facing in our real world. They play an ever-growing role in our daily life and different options to support the educational development. Because games can be employed for another learning and teaching techniques that encourage players to be interested in learning and want to participate in it under an exciting and challenging designed environment. In addition, the game-based learning encourages learners to try their potential and relevant knowledge to achieve the goals of the game. In class, this

similar concept can be used to encourage all students not to be discouraged by the obstacles they encounter in school and outside of campus [1].

Interactive narrative games refer to narrative games in which the player can participate in the actions and make their own decisions on the avatar characters in game. Whether forcing the character to walk around in the collection scene or deciding the situation and many other actions can occur in a game. All these relate to the story within this game, which is the most important. Every word of the characters in the game decides what we should do or decide next.

There is some research that has developed a virtual stroke assessment media aimed at optimizing the game-based training approaches. In their report on assessing the acute stroke, it was found that media users preferably chose virtual visual media over simple visual media in training [2].

According to the study, the development of educational games about stroke first aid as a guideline of correct implementation, the designed game will provide the knowledge and understanding of stroke symptom and its stroke related first aid procedure to game player. This could lead learners to apply the knowledge gained from the game to practical use in any stroke patients' rescue situation.

2.2. First aid for stroke patients

As aforementioned before, in Thailand stroke is one of the major causes of disability and the second leading cause of death [3]. There is also no treatment for this kind of cerebrovascular disease. But we can avoid it by changing our lifestyle behaviors on eating and exercising. Moreover, we can also assist others in urgent rescue situations by providing first-hand first aid to lessen the severity in a stroke patient who needs responsive assistance. Therefore, learning first aid techniques is crucial.

Providing the first aid means to assist patients or those who are injured or have caught in an accident right away on the accidental scene by using whatever tools that are available at the time to help the patient or victim from mortal danger before being in hand of emergency medical unit and transporting them to the hospital for treatment. To reduce severity of accident or illness complications, prevent disabilities, and hasten the healing process, proper first aid must be provided early at accidental scene [4].

3. Approach

The approach in this study consists of designing the goal of game, interactive storytelling and detailed game design, and gameplay.

3.1. Goals of Game

The aim of our game is to be designed for game players to learn and understand what stroke and its symptoms are, including risk factors, warning signs, preventions, proper assistances, and treatments. Experiencing through the game with all goals designed in it can make players feel entertained and familiar simulating events in game to real-world situation in our daily life living

3.2. Game Design

Interactive storytelling game educating first aid in stroke patients is a 3D game in which players can interact. The atmosphere in the game is simulating a player to feel the real experience and fun from playing it. In this designed game, a player takes on the role of a young college student who comes to eat at a restaurant after participating in university activities. While he was ordering his food at cafeteria, he noticed that the staff at the food court acted strangely. After a while, an unexpected event happened, the player had to step in and help that employee by following all game plan and characters to succeed the goals.

3.3. Game Play

In participating with game, it requires players to complete a pre-test questionnaire via a Google Form before they begin playing a game. The game players will find a tutorial explaining how to control their characters, choose replies, check item descriptions, and know the game's objectives are before starting a play.

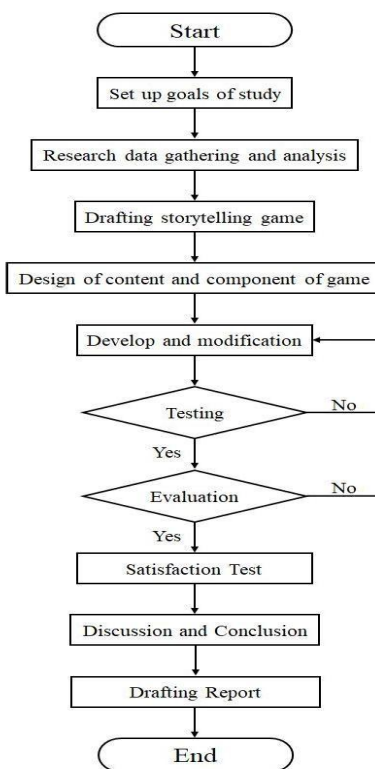


Fig. 1. Workflow of the proposed game-based development

To be more reality, we simulate the different daily scenarios in which a stroke might occur. The circumstances can be chosen by the player which will present options for the player to select from, and the game's outcome will depend on the player's preferred course for the narrative. After completing the game, each answer will be explained along with how it will impact players, to improve the player's knowledge and comprehension of the proper stroke first aid procedure. The player also needs to answer a post-test questionnaire via a Google Form to determine whether their understanding has improved after finishing a play and the option for player to complete the given surveys to rate their enjoyment from playing our games. Figure 1 shows the whole study procedure of developing the interactive game based self-learning for stroke first-aid procedure.

4. Methodology

In this section, the demographic data from participants involved in this study, related survey tools and statistics measurement, analysis of the collected data are described. The limitation to this study is also given at the end of section.

4.1. Participants

All participants can be categorized into three groups which are (1) two specialists in game design and (2) two specialists in first aid for stroke. Both volunteer groups are chosen through a purposive sampling. (3) 30 volunteer game players who are randomly selected from the general population by accidental sampling. All volunteers have their age range from 15 to 25 years old.

4.2. Survey tools

In study there are two types of instruments used for gathering information and data collection.

- 1) Gameplay data: It gathers the related information to the story's development through player responses.
- 2) Questionnaire: This tool can be divided into 4 groups of collective data, which are (1) evaluation criteria on the quality of designed game for the game experts, (2) validity assessment of game content for the experts in first aid for stroke patients, (3) questionnaire on the game players' satisfaction towards the game, and (4) Comparative tests to measure and compare the players' knowledge improvement between before-playing and after-playing, known as pre-test and post-test. The Google forms have been used for collecting all relevant information online from all participants.

4.3. Data Analysis Method

The t-test was used to compare two groups of samples that were related. It is a statistic used to test the data of the same sample group that is less than 30 people ($n < 30$). Used to compare the results of the pre-test and post-test of the same group of learners. whether the difference is statistically significant or not.

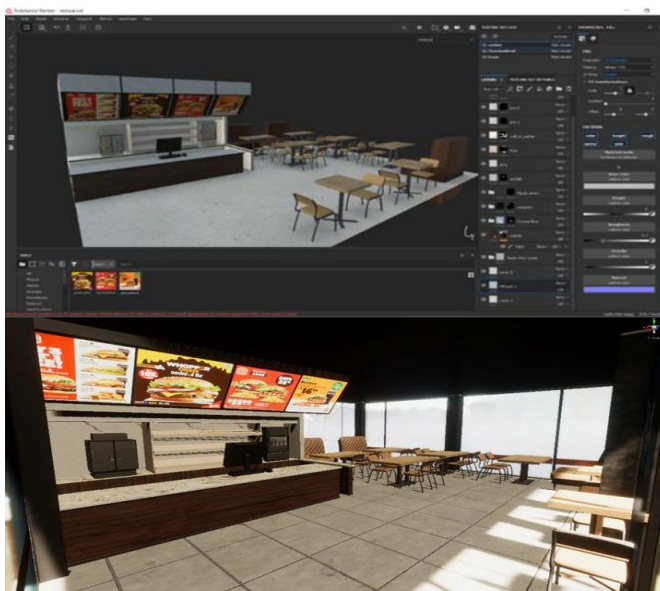


Fig. 2. Design of fast-food scenes

$$t = \frac{\sum D}{\sqrt{\frac{n \sum(D)^2 - (\sum D)^2}{n - 1}}}, df = (n - 1) \quad (1)$$

Where D is the difference value between parameters, n is the number of total sample groups, and t is a t-test statistic.

4.4. Limitation

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5. Result and Discussion

In this section, the summarized results obtained from study and statistical explanations are presented. Table 1 shows the mean and standard deviation values, and interpretation of the quality level on the proposed

the evaluated result of game quality based on the game experts' opinion is at a good level with a mean of 4.46 and an S.D. value of 0.43 respectively. These numbers suggest that the experts' opinion towards the stroke first aid game have weighed the game for its good quality. In details regarding quality assessment on game, the gameplay is found to have the highest average of 4.75 and the sound design was evaluated to have the lowest mean value of 4.00 with the smallest S.D. value among game quality assessments.

Table 2 shows the evaluated result from the quality level of interactive storytelling game based on two experts in first aid for stroke patients. In Table III, the knowledge gained after playing game shows the highest mean value of 4.66, and the scene design and the consistency of content are the second and third runner-up with means of 4.65 and 4.50 respectively.

Table 4 shows the mean values, standard deviation, t-value and significant difference of the knowledge gaining tested before and after playing game by the sample group of 30 volunteers. The knowledge gained from the game, the overall level is very good. Players can understand more about first aid after playing the game. This is corresponding to quality assessment results of accuracy by first aid specialists with very good quality.

TABLE I. RESULT OF GAME QUALITY OF ASSESSMENT

Game Quality	Mean	S.D.	Level
<i>General elements</i>	4.25	0.50	<i>Good</i>
<i>Scene Design</i>	4.66	0.41	<i>Very Good</i>
<i>Animation</i>	4.50	0.71	<i>Very Good</i>
<i>Graphic Design</i>	4.66	0.41	<i>Very Good</i>
<i>Text Design</i>	4.25	0.50	<i>Good</i>
<i>Sound Design</i>	4.00	0.00	<i>Good</i>
<i>Gameplay</i>	4.75	0.50	<i>Very Good</i>
Average	4.46	0.43	Good

TABLE II. RESULT OF GAME CONTENT ASSESSMENTS

Content Correctness	Mean	S.D.	Level
<i>Content</i>	4.50	0.00	<i>Good</i>
<i>Situations</i>	5.00	0.00	<i>Very Good</i>
<i>Usability</i>	4.50	0.71	<i>Very Good</i>
Average	4.75	0.39	Very Good

TABLE III. RESULT OF SATISFACTION ASSESSMENTS

Satisfaction Assessment	Mean	S.D.	Level
<i>General Elements</i>	4.37	0.72	<i>Good</i>
<i>Scene Design</i>	4.65	0.11	<i>Very Good</i>
<i>Text Design</i>	4.35	0.04	<i>Good</i>
<i>Interactive</i>	4.33	0.09	<i>Good</i>
<i>Gameplay</i>	4.30	0.02	<i>Good</i>
<i>Content Consistency</i>	4.00	0.00	<i>Very Good</i>
<i>After-Knowledge</i>	4.66	0.63	<i>Very Good</i>
Average	4.44	0.08	Good

TABLE IV. RESULT OF SATISFACTION ASSESSMENTS

Comparative Knowledge	Mean	S.D.	t	Sig
<i>Pre-Test</i>	4.33	2.56	8.084	0.00**
<i>Post-Test</i>	8.47	1.61		



**Statistical Significance <0.05

Fig. 3. Tutorial page

6. Conclusion

The interactive game-based learning package was designed and developed to be supportive of emergency rescue in stroke patients. This task is important to comprehend and support stroke victims in emergencies outside the healthcare facilities. This designed game is a 3-D interactive game that can simulate real-world situations, so that players can experience its reality while enjoying the game. To collect information about the players' satisfaction towards the game, questionnaires were used gathering information from 30 volunteer players. Their background knowledge regarding the first aid procedure and symptoms of stroke patient were tested before and after playing the game. The findings from this study indicated that players have much more knowledge and satisfaction from playing games. In the opinion of some players, the game could be improved to give players more challenge and excitement.

7. Acknowledgment

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8. References

- [1] N. Charlier, "Game-based assessment of first aid and resuscitation skills," 2010, Belgium, 2010.
- [2] M. S. Mancosu, "Evaluation of Stroke Assessment in Simulated Virtual World," in 2020 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct), Recife, Brazil, 2020. <https://doi.org/10.1109/ISMAR-Adjunct51615.2020.00087>
- [3] [Online] <https://www.bangkokbiznews.com/social/1006128>.
- [4] Tipawon Ruengkajon, "First Aid." Faculty of Science and Technology, :Songkhla Rajabhat University, 1999.



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