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## PRELIMINARY STUDY: FLOOD AWARENESS TRAINING PREPARATION USING SERIOUS GAMES

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### ABSTRACT

Serious games are games that educate, train and enlighten by using the entertainment principle, creativity and technology. Serious games can provide efficient training in a safe and relatively inexpensive immersive environment. Therefore, it is believed that serious games have the potential to be used in flood training. Flood is a common disaster that happens every year in Malaysia. However, the level of civilians' awareness of flood preparation is still low, while the existing method does not achieve the objectives of The Malaysia Civil Defence Force (APM). The objective of this paper is to present an analysis of flood awareness training preparation among the Malaysians, the existing method on dissemination flood information awareness and the need for technology requirements to carry out the flood awareness training preparation from the experts' perspective. Data was gathered in this study by using the semi structured interview method. Future studies will provide further evidence on the positive impact of using a serious game for flood training preparation, and take into a consideration for the best approach to develop a serious game for flood training to provide and create awareness to the civilians regarding the importance of flood preparedness.

Keywords: serious games, serious games training, flood disaster, flood awareness.

### INTRODUCTION

A game is defined as a physical and mental competition played in accordance with certain rules, with the sole purpose of using or entertaining the participants (Laamarti, Eid, & El Saddik, 2014). The growing demand in the game industry has resulted in an increasingly popular digital game among users as games have interactive technological features in the multimedia learning environment (Raihan, Abidin, Fadzilah, Noor, & Ashaari, 2017), (Zin & Yue, 2009). Game industry also include alternative input modalities for games to provide an enhanced and more immersive user experience (Zain & Jaafar, 2011).

One of the more popular digital games is a serious game that are not for entertainment purposes but to serve as a tool to educate. Serious games can be used as an effective teaching tool because it resembles a complexity of environment like the real world and at the same time, these games enable players to learn from its contents (Onencan, Kortmann, Kulei, & Enserin, 2016).

Serious games can be used for training as guidelines to convey informative information based on the situation because they are from the player's point of view and enable the player to be in the game's situation (Guo, Singer, & Bastide, 2014). Serious games can provide players with experience and making them enjoyable in a safe and reasonable situation these enables users to gain the knowledge, skills, and competencies that can be applied to life (Paolis, 2012), (Dede, 1995), (Muslim, Wook, & Zin, 2014). Moreover, serious games in training are also

suitable to train a person directly in various fields including education, safety training, and medical, whereby the games system are used to create simulation based on the real environment of a training process (Samcovic & Jaume-I-Capo, 2013).

Although serious games have been used widely, they need more research to ensure the effectiveness and at the same time to make people understand the important issues. One of the instances where serious games have been used is in natural disaster training. Natural disaster is a phenomenon which occurs all around the world in various ways such as earthquakes, typhoons, landslides, forest fires, tsunami and floods.

According to Reser and Morrissey (2012) natural disasters can be recognised by the World Health Organization (WHO) as an 'Ecology phenomenal that happens suddenly that results in need of external assistance'. It is also known as any situation that happens suddenly resulting in damage, ecology change, loss of lives, economic crisis, health care deterioration, and the halt of daily routines.

In Malaysia, according to Agensi Pengurusan Bencana Negara (2018), flood is a natural disaster that happens frequently. It is a natural disaster that needs attention because flood has a negative impact on human lives and infrastructure (Anindita, Laksono, & Nugraha, 2016). The Malaysia Civil Defence Force (APM) is responsible in handling flood situations. Therefore, there is a need to expose and educate people, especially flood victims, on the awareness of flood (Azadegan, Riedel, & Hauge, 2012). Their actions toward flood awareness are important in order to adopt the survival skills and immediate responses in hazardous situations.

The paper presents an analysis of flood awareness training preparation among the Malaysians, the existing method on dissemination flood information awareness and the need for technology requirements to carry out the flood awareness training from the experts' perspective. This paper will be divided into several sections including introduction, related work, method of the study, results, discussion, and conclusion of this paper.

## RELATED WORK

### FLOOD

Flood is a natural disaster that happens frequently and contributes to the highest nature damage compared to other natural disasters (Douben, 2006). Flood can be defined as a body of water, rising, swelling and overflowing onto land. According to Ceola, Laio and Montanari (2014), flood happens in various countries with different magnitude, duration and frequency. In between 2011 and 2012, 200 million of the world population were flood victims with a loss of about US\$95 billion.

According to a statistic, in Malaysia flood disaster has affected the most number of people (Kalid, Hooi, & Shan-Nice, 2016). Usually floods will happen in East of Coast states of Kelantan, Terengganu and Pahang because of monsoon. In February 2011, the southern state of Johor was inundated by floods (Azmi, Hashim, & Zamhury, 2012). When flood happens, it will bring devastating effects to the society. Flood can cause excessive damage including loss of life, loss of property, damage to infrastructure and also increases in health problem (Rothkrantz, 2016). The damage may affect people's daily routines and the economic flow (Yahya, Rodzi, & Ahmad, 2014).

In a study conducted by Jonkman and Vrijling (2005), the effects of floods resulting in various types of damages that caused losses such as environmental damage, economic deterioration and loss of lives were discussed. Among these losses, loss of lives is considered the most valuable loss. Flood fatalities occur depending on the level of flood. Deaths are influenced by the behaviors and weaknesses of individuals. Therefore, safety measures are reviewed to reduce the rate of loss and deaths due to floods. The results of this study contribute to the strategy of prevention and reducing the loss of lives due to floods. Among the steps

identified is analyzing flood characteristics such as the depth of water and the precautionary measure taken is by increasing the velocity rate of the water flow, so that the water can flow.

Next, a study conducted by Jonkman (2008) discussed about the loss of lives due to flood. This is considered to be the most serious impact of flood occurrences as compared to socio-economic losses. This study focuses on the analysis of mortality due to specific floods. Every flood is caused by the characteristics of the flood area. The level of damages caused by floods is influenced by physical features such as the hydraulic characteristics, water depth, velocity and rate of increase of water. This affects human assets and lives. This study highlights six types of floods, namely coastal floods, flash floods, river floods, drainage problems, tsunamis and tidal waves. The type of flood shows the difference in the predictions of life loss. The results of this study show that good preparations in facing floods can reduce mortality rates. Therefore, good planning on floods management enable the agencies and civilian involved in flood management to make better decisions in terms of handling emergency situation (Dorasamy, Raman, Muthaiyah, & Kaliannan, 2011).

#### PREPAREDNESS KNOWLEDGE IN IMPROVED AWARENESS OF FLOOD

Many people know that flood is unavoidable and unpredictable, however, there are ways to prevent loss of lives and properties by preparing before it happens (Levac, Toal-Sullivan, & O'Sullivan, 2012), (Paton, 2003). Preparation can be defined as the knowledge, capabilities and actions of the government, organizations, community groups and individuals, that can predict, go through and restore effectively for the after flood effect (Chen, Wilkinson, Richardson, & Waruszynski, 2009).

According to Wood et al. (2012), flood preparation is important to determine the civilians' ability to experience natural disaster. Other than that, it is to ensure civilians are ready to go through other natural disasters with preventive actions (Christopher, Liljelund, & J. Mitchell, 2001). Moreover, if they have systematic preventive actions, these will reduce the physical, social, economy and psychological impact (Mabuku, Senzanje, Mudhara, Jewitt, & Mulwafu, 2018). Existing research shows that a person who is weak during a natural disaster is a person who does not have any preparation before the disaster (Eisenman, Zhou, & Ong, 2009). Therefore, flood preparation actions need to be implemented to educate civilians by informing them about flood risks and effects, and at the same time to raise awareness about the importance of flood preparedness.

More attention is needed for planning and training to increase civilians' readiness to learn about flood. This is because a flood is unpredictable and it is difficult to understand the flood pattern and situation (Risk & Hartevelde, 2008). Therefore, serious games for flood training is needed for flood preparation.

A study by Bradford et al. (2013) is concerned with raising public awareness about the effects of floods on living beings. Although the public is aware of the risks and effects of the floods, they have no awareness to prepare for the flood. The results of this survey find that there are people who are unaware of the risks and impacts of floods. This shows that people are still at a low level of flood awareness. Therefore, researchers suggest increasing media-related flood awareness campaigns to raise public awareness on risks and hazards of flood. Besides, specific information should be provided such as flood safety measures to facilitate the people in protecting their properties and lives. Communities need to realize that communication is important when it comes to floods. Before the occurrence of flood, people need to understand the basic things to face the flood. Furthermore, flood management authority also plays a role to provide early information to the public so that they readily know what to do if and when a flood occurs.

Next, a study by Fielding (2012) examined flood awareness of those who are at risk of flooding in England and Wales. Flood risk is a growing issue in the United Kingdom, especially since the devastating floods that took place in 2007. In England and Wales alone, about 5 million people and 2 million properties have been identified as flood-prone areas. Since the severe flood occurrences of 1998, 2000, and 2007, high priority has been placed on the parties responsible for raising public awareness of flood risks. The scale of potential social and economic disturbances is becoming more apparent as a result of the frequent floods. The purpose of the research is to study the causes of the risk of flooding in the area. Awareness campaigns are designed to educate and expose the public to flood facts to ensure they get useful information about flood occurrences.

#### SERIOUS GAMES

Serious Games are referred to digital games aimed at teaching, training or giving new knowledge to the players. These types of games that utilizes all the features which make the game fun and interesting and to be used to provide training. Additionally, it can also be used to alter the trust and attitude of the players about an issue (Moffat & Shapiro, 2015). The main goal of serious games are usually to train or educate users, though it may have other purpose while giving player an enjoyable experience.

Growth of serious game in the research field other than training, serious games are also used in other fields such as education and heritage (Laamarti, Eid, & El Saddik, 2014). Laamarti et al. (2014) has developed a serious game for cultural heritage. The game aims to present a cultural heritage to the public with entertainment. For education field, according to Ulicsak (2010), serious games, which are also known as “educational games”, are used in the education field to focus on the development of players’ skills and knowledge. Serious games in the field of education are considered to be helpful in motivating the students to play games.

#### SERIOUS GAMES FOR TRAINING

Serious games for training is a way of implementing skills by practicing, and the games will be able to train individuals in an educational way through experiences (Buendía-García, García-Martínez, Navarrete-Ibañez, & Jesús, 2013). According to Kleermaeker, Deltares, Zijderveld and Thonus (2011) serious games are used as teaching aids in the existing training method as an alternative to maintain skills. Other than that, the use of serious games can be utilized for an entertainment without neglecting the main objective of the training.

Serious games developed by Ziebarth, Kizina, Hoppe and Dini (2014) in the medical field are used for training first year students to have two-way communication between doctor and patient. This research has focusing on how the doctors will be trained to communicate with patients better while treating them. The game’s objective is to increase student’s motivation so that they will be able to increase their communication skills with patients. The weakness of this game is it has less simulation information about patient and usability. Because of that students are unable to test and differentiate communication strategies. The outcome of this research is that serious games are able to reduce patients’ complaints regarding doctors’ services.

Research Brazil et al., (2016) discussed about the use of serious games simulation for training in epidural anaesthesia using haptic device. The serious game provided an opportunity to students to learn about the epidural anaesthetic procedure before they are in a real situation with a real patient. Besides helping trainees to be experts in medical procedures, serious games are also able to increase their motivation, attract their interest and provide experience to trainees throughout their learning process. Apart from that, with the existence of serious games, training duration of the trainees can be reduced in order for them to gain expertise.

In fire training, a research by Chittaro and Ranon (2009) developed a serious game to train safety skills in a fire, privately to individuals. During a fire, an individual is in a panicked situation while waiting for the rescue team to come. This is likely to cause irrational behavior. Individual behavior is important because it affects the rescue process. Besides that, minimal knowledge in basic safety in a fire can lead to various behavior from individuals that are not ready to be in the situation. Other than that, individuals that are not ready in an emergency situation will lose their ability to think creatively and affect the way they behave. Therefore, training is required regarding what needs to be done before the rescue team arrives in order to avoid a panic.

A serious game in forensic investigation training emphasizes security aspects based on the police academy training procedures around the world (Drakou & Lanitis, 2016). The use of virtual environment-based serious games in the training of forensic investigations is to support the development of computer-based systems for cadet training in forensic testing. The results of the assessment indicated that it is desirable to use computer games as part of an interactive training for forensic testing. The results of the assessment were based on user experience and forensics experts found that the user knowledge on forensic investigations has increased after playing games. This demonstrates that the developed prototype of the game can be used as an integrated educational tool for training in forensic investigations.

The main objective of the simulation of war games is to facilitate education and officer training on the subjects of war ethics and international humanitarian law. The game by Veziridis, Karampelas and Lekea (2017) provides a simulated environment to face the real situation on the battlefield. Cadets need to choose the best tactics to complete the task. They need to think and solve problems as if they were responsible on the actual battlefield. As a result of this game, cadets admit that their understanding of war training increases with the use of the game as the game provides cadets with virtual experiences as in real battlefields.

#### SERIOUS GAMES FOR FLOOD TRAINING

The Stop Disasters game is an international strategy to reduce disaster (Pereira, Prada, & Paiva, 2014). Stop Disasters is a game where players need to use limited resources to solve the task of reducing natural disaster effects. Players are given money (USD 50,000) to buy the resources needed to reduce natural disaster effects. Natural disaster effects will be minimized if the right strategy is implemented. This game enables players to be proactive in creating strategies to reduce civilians' weaknesses. Players scores are determined live by its effectiveness and player efficiency in using the resources. This game uses time that has been set to control its flow. There are various natural disasters that can be chosen including tsunami, fire, flood, earthquake and typhoon.

There is various research that have been developed for serious games for flood. Mannsverk, Loreto and Divitini (2014) developed serious games to increase civilian awareness about the importance of preparation in facing floods. Civilians are still lacking of exposed on the knowledge on flood training, therefore the serious game is built to help them simulate a real flood situation and be safe. Serious games have the potential to create awareness among civilians about the need to prepare for a flood disaster and have been the potential to engage the public and raise awareness. They are simulated through the game with the scenario of a real flood situation without danger to any lives. This game is based on the location, which is, the real location of the flood. This is to enable the player to understand ways of how to get food in those places. A game design that can be used to promote flood preparedness, as well a prototype of a location-based serious game that acts as a proof-of-concept for the design. The game is played on a mobile with interaction with a global map, the players need to have a smart phone with a connection to the internet. Results of the evaluations show that the game was

successful in promoting flood preparedness, especially in terms of increasing the player's knowledge of the local territory, but that a proper briefing and debriefing session is required to facilitate learning, retention and reflection.

The design of a serious gameplay is based on initial warnings in the context of training (Ziebarth, Kizina, Hoppe, & Dini, 2014). A system that integrates a serious game with early warning systems as a form of effective training in flood preparedness. Due to the rarity of the flood, professional training cannot be done frequently because the need to conduct training is costly. Therefore, the use of serious games seems appropriate as it provides alternative training that can sustain skills. This game focuses on the training program in development for a Dutch crisis response group, the Storm Surge Warning Department of the Netherlands (SVSD). This crisis response group is part of the early warning system of the Netherlands, they generate predictions of water levels based on weather forecasts and water level measurements using water level prediction models and expert judgment. Based on the predicted storm surge levels, they have to inform and warn the appropriate parties involved in keeping the Netherlands safe from flooding. The gaming and learning experience becomes more realistic and the trained skills can be applied directly in the operational early warning systems. Furthermore, the FEWS game is set-up generic and flexible such that every forecasting system based on Delft-FEWS software can make use of the same game functionality.

Harteveld (2008) explains how games can be useful in solving problems of flood defense. Among the issues discussed is the definition of a serious game, how serious games can be incorporated in flood defense, and describing the example of the Levee Patroller application. According to Juul (2005) and Salen and Zimmerman (2004), a game can be viewed as a rules-based system with variable outcomes. Additionally, the game provides an exciting environment, gives players an experience, and is safe to use. In games, users are participants who need to understand and act according to the rules of the system to achieve the goal. The use of serious games for flood defense has two values, which are educational value and organizational value. The educational value increases the level of awareness of professionals and the public by making them more prepared during the flood crisis. Serious games can have an organizational value. These games could become a knowledge repository, provide a shared and explicit vision, and stimulate discussion.

Serious games developed by Kolen, Thonus, Zuilekom and Romph (2011) give training and planning for flood evacuation when a flood occurs. A game simulation is built to train on evacuations and to move flood victims in an emergency situation. The use of serious games all over the world is able to make players experience situations which are impossible to be experienced in real life because of safety, cost, time and situation factors that rarely happen to the players.

## METHOD

In this paper, an interview method is used to gather the appropriate data in order to achieve the objective of this study. The objective of this paper is to present an analysis of flood awareness training preparation among the Malaysians, the existing method on dissemination flood information awareness and the need for technology requirements to carry out the flood awareness training preparation from the experts' perspective. A method that had been employed is shown as Figure 1 and this study was conducted by following phases:

1. Phase 1 (Setup): Identify the objective of the preliminary study, preparation of the instrument and identify the informants.
2. Phase 2 (Data collection): Data collection was carried out by conducting interview sessions with the informants.

3. Phase 3 (Data analysis): Analysing the answers from the interview has been conducted.



FIGURE 1. Method Of Preliminary Study

#### PHASE 1: SETUP

There were three steps that involved in the setup phase, namely; identifying the objective, preparation of instrument and identifying the informants. In the first step, the objective had been identified as abovementioned. The description of the second and the third step as the following:

##### PREPARATION OF INSTRUMENT

A set of questions had been constructed based on literature. The questions were divided into four sections. Section A focused on the demographics, while Section B focused on Awareness of flood training preparation among the Malaysians, Section C focused on the existing method on dissemination flood information awareness and lastly Section D focused on game application for flood preparation training.

##### IDENTIFICATION OF INFORMANTS

The informants that involved in this interview were six members of the Malaysia Civil Defence Force (APM). The informants were selected based on their experience serving as members of the APM that manages flood disasters. Interviews were held at the Malaysia Civil Defence Force Training Academy (ALPHA) in Bangi, Selangor. There are 28 questions that have been asked. Questions have been constructed based on literature review. The interviews were held over three days and took 530 minutes to interview all informants with an estimated 1 hour and 30 minutes per informant.

#### PHASE 2: DATA COLLECTION

The method used in conducting the preliminary study was a semi structured interview. The interviewer started the interview session by introduced herself and explaining the purpose of the interview. Then the interviewer conducted the interview according to the guidelines that were prepared with the prescribed questions. The interviewer also added questions based on feedback from informants to get further information. Each interview session was recorded to facilitate the data analysis process.

#### PHASE 3: DATA ANALYSIS

The conversation from the interview session was transcribed in the form of writing for analysis. The obtained data were analyzed using thematic analysis techniques to identify, analyze and report according to the themes. Then, the data was organized and categorized into multiple groups that based on the same theme and the relationships between each of these themes were identified.

## RESULT

In this section, the results based on the findings from the interviews are discussed.

### AWARENESS OF FLOOD TRAINING PREPARATION AMONG THE MALAYSIANS

Through the interview with the awareness of flood training preparation theme, it was found that all informants stated that the level of awareness of civilians regarding the importance of flood training preparation is still low. This can be seen from the low attendance of civilians when the APM conducted any kind of training activities. They think that their own experience is enough because floods are a usual phenomenon and does not have any bad effects.

According to the informants, if flood preparation training is used, civilians will be more ready especially during the flood season. Apart from that, with the experiences gained from the training, they would not need to wholly depend on APM (flood management). At least before the APM arrives, they will know what needs to be done. Moreover, the preparation is not only from a physical aspect but also mentally and emotionally.

Table I states that the current APM method campaign for flood training preparation uses pamphlets, mass media, flood management courses and also do some trainings in community programs. These methods are conducted in at-risk flood areas so that the civilians will be prepared when it happens. However, these methods did not receive positive feedback from civilians. Therefore, APM needs to use more intensive efforts in creating awareness among civilians.

The APM provided an opinion on technological requirements. Five of the informants stated that technology use is needed to help APM in conveying information to civilians so that it will increase their awareness. Everyone needs to follow the present technology change. Informants believe that APM needs a specialized application to provide information, which is accessible for civilians to train.

TABLE 1. Campaign Used For Flood Training Preparation.

Campaign	I-1	I-2	I-3	I-4	I-5	I-6
Pamphlet		/			/	/
Mass media	/	/				
Flood management course		/				
Training in community programs			/	/		

I = INFORMANT

### EXISTING METHOD ON DISSEMINATION FLOOD INFORMATION AWARENESS

Based on the findings, existing method to convey information to civilians that has been analyze show that APM use video, television, text, audio and social media as a shown in table II. APM uses a video that is uploaded in the APM website and social media to convey information to civilians. However, all informants stated that it still less effective to civilians because they do not seem to have awareness in preparing for a flood. APM also found that civilians do not watch the uploaded video because they do not access the APM website. Moreover, watching it does not increase civilians understanding because it is not so informative.

The other existing method to deployment of information does not achieve APM's objective to create awareness among civilians. Therefore, all informants stated that the existing method needs to be upgraded in an effective technology way so that it can stimulate the minds of the civilians to more understand what to delivered by APM. Nowadays, people are more engaged to work online using internet their need a technology that can convey information and



at the same time allow to interact with it. For example, interactive games that involve players and the games itself.

Games have the potentials to be used in training because of their features that can engage players in the real situation. In addition, the games have graphic design that is user friendly and can provide civilians with good knowledge. Furthermore, usage of a new medium in technology can attract civilians' interest and motivate them to do preparation training.

TABLE 2. Existing Method To Convey Information.

Existing method	I-1	I-2	I-3	I-4	I-5	I-6
video	/	/	/			/
television						/
Text	/	/				/
Audio		/				/
Social media				/	/	

I = INFORMANT

### GAME APPLICATION FOR FLOOD PREPARATION TRAINING

The interview result shows that all informants accepted the suggestion of using serious games for flood preparation training. They also proposed features of the game for flood awareness training using serious games, as listed on Table III. They agreed that the use of games can also attract interest among the civilians to join APM. This is because APM needs interactive games that are not only focused on entertainment but also has the elements and modules that are assigned by APM.

TABLE 3. Games Features For Flood Awareness Training Using Serious Games.

Game Features	I-1	I-2	I-3	I-4	I-5	I-6
Interactive	/	/	/	/	/	
Interesting	/		/			
Feedback		/				
Colorful			/			
Web base	/	/	/	/		/
Suitable for all ages			/			
Online game				/		
Not for entertainment only				/		
Suitable for training						/

I = INFORMANT

### DISCUSSION

From a result of the preliminary study, it has shown that the community is still unaware of the need to prepare for flood crisis. They believe floods are a common occurrence and need not be given attention due to their experiences from previous flood disasters. But, they are unaware that the scale of flood disasters cannot be predicted whether on a large or small scale. If floods occur on a small scale, they may be able to save themselves but, if large-scale floods occur and they are unprepared, this may lead to bad consequences.

For example, in 2014, large-scale floods occurred on the east coast of Malaysia which cost many lives and properties. These large-scale floods were beyond prediction and assistance could not reach the badly affected rural regions. If this matter is not addressed, the public will be negligent and take it easy on flood crisis. Hence, appropriate measures should be taken by the disaster management to create an awareness among the public so that they are always prepared with knowledge to face flood disasters. One of the forms of flood preparedness is

through training. Training should be held in a variety of forms and continuously. Through training, the public can obtain information and, at the same time, gain useful experience for use during flood disasters. Preparatory training should not only be in physical form but also should emphasize in mental and emotional aspects.

The APM has taken several steps to create awareness among the public by raising awareness campaigns on the importance of flood preparedness, however, these campaigns lacked public response. Therefore, the APM needs a more effective technology to implement these campaigns. In the era of rapidly developing technology, people are more likely to receive information and conduct training in the form of interactive technology to enable them to interact with the technology. Hence, it is necessary to produce new mediums in the form of technology to conduct the training. One of the best technologies to train is in the form of serious game technology.

Serious games are not just for genuine entertainment but, also to serve as a tool to educate and instruction purposes. The main importance of a serious game in training is to build or unify a set of skills as a new educational tool. Serious games are also used as an effective teaching tool since they resemble complex environments such as the real world. At the same time, serious games also allow players to learn the contents delivered by the games. The features in the serious games are in accordance with the technological features required by the APM to raise public awareness of the need for flood preparedness. With a serious game for training purposes, it can be increasingly used to invite trainees to a more active and engaging participation which may improve their sense of knowledge, experience and involvement.

Preparations in the form of safety training using this serious game were developed to train the community so that they will know the necessary measures that must be taken if floods occur, hence, they do not need to be worried and be able to take security measures to control the situation wisely. Safety measures will be explained clearly through the serious game developed. In this way, people are more easily aware of the knowledge delivered by the APM.

As an interactive technology within the multimedia learning environment could foster learning process effectively and interestingly this serious game is suitable for all walks of life especially among young learners (Zin, Yue, & Jaafar, 2009). Apart from the public, the APM trainers themselves can use this game to practice during the training period with the APM. This game can be used as a hands-on material in the classrooms to make the class more interesting and effective. The APM management can also upload this game on the APM website to allow the public to play while undertaking the training. From here, they are indirectly informed and aware of the need for flood preparedness. In this way, the APM's knowledge can be spread widely to the public and can attract their interest to join APM.

## CONCLUSION

This paper has discussed the results from the preliminary study on the analysis of flood awareness training preparation among the Malaysians, the existing methods on dissemination flood information awareness and the need for technology requirements to carry out the flood awareness training preparation from the experts' perspective. Awareness on flood training preparation is quiet crucial because people need to have responsibilities when involve in such hazardous situations. Preparing themselves both physically and emotionally will guide them in reducing risks of injuries and death whenever a flood occurs.

However, with the existing method there is still low awareness about the importance of flood training preparation among civilian. Flood victims need to have complete knowledge to understand and practice the preparations in order to be in a state of readiness and to know the steps to be taken when a flood happens. Because of that, serious games are considered to be one of the technology which can be utilized to provide the needed awareness to citizens on the

importance of training preparation when dealing with flood situations. Based on our results, future studies will provide further evidences to the positive impact of using serious games for flood training preparation. This will also look into the best approach to develop serious games for flood training in order to provide awareness to the public regarding the importance of flood preparedness.

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