ASM Sc. J., 13, Special Issue 3, 2020 for CIIDT2018, 94-99

A Historical Educational Game for Learning Support: Design and Evaluation of Pre-Mortem

Suhaila Khalip*, Muhammad Amirul Ramli and Muhammad Irsyad Abdullah

[1]*Faculty of Information Sciences and Engineering (FISE), Management and Science University, Shah Alam, Selangor, Malaysia*

Nowadays a lot of technology offers a new approach for teaching and learning such as digital games. Digital games are an interactive technology that can foster the learning process effectively and interestingly especially among undergraduate students but using digital games in teaching and learning history has received less attention in research. Besides that, the lack of creativity in teaching history caused students to become bored and lose interest in the course. To fulfil the gap a puzzle platformer digital game called Pre-Mortem has been developed. This study summarizes design ideas and the result of evaluations conducted with undergraduate students. The game featured with gameplay that makes the player think beyond logical explanation to solve the puzzle, suitable with surrealism itself, an expression of thought from both conscious and sub-conscious mind not dictated by moral and aesthetic value and defy any form of logical explanation. This game can support learning, especially surrealism in modern art based on the topic cited in the Art History course. Producing a historical educational game is becoming an effective educational tool to support learning for students.

Keywords: digital games; art history; surrealism; learning retention; game development

I. INTRODUCTION

Many university students are not interested in learning history (Michael, 2013; Swist & Kuswara, 2016; Hamza Akengin & Meltem Elif Cendek, 2017). The same is the issue with students in the class of Art History. Some find it difficult to memorize the historical facts and this makes them demotivated to learn the subject (Azan, Zin & Wong, 2014).

But nowadays, digital games can be both entertaining and provide information simultaneously. In the current situation, the young generations' attitudes toward digital games are advanced during the learning process. To make people learn and be entertained the developer needs to be creative and do something beyond one's imagination to merge the content of learning and the motivation of the game.

A lot of technology offers new approaches to learning and mastering new skills. Digital games are one of them. Digital games can be entertainment or education. It can offer endless possibilities for ways to create a new approach to assist the learning process. Games can express good moral values either through the gameplay or the storytelling methods and flexible enough to apply some educational value to allow participants to learn about new topics. Merging the content of learning and interest to play games will make the subject history interesting and fun-based.

In this paper, a game Pre-Mortem is presented to help the students to learn the concept of surrealism in art history. It exposes people to the concept of Surrealism and assists the player in memorizing the facts about artists and paintings in Surrealism. User requirements are collected through user evaluation with university students. Based on the results, the game Pre-Mortem was designed and implemented. The effectiveness of the game Pre-Mortem is quantified through 47 university students undergoing the Graphic Design program.

II. LITERATURE REVIEW

Digital games are considered to be effective tools for

*Corresponding author's e-mail: suhaila@msu.edu.my

teaching because they use action instead of explanation to motivate and give satisfaction to accommodate various learning styles and skills (Battistella and Gresse von Wangenheim, 2016). According to Seaborn and Fels, 2015, digital games can also boost motivation to learn and well-designed games can motivate the student to learn less popular subjects, such as history and math. To develop a digital game that able to assists in learning art history simultaneously provide engagement experience to the player, the principle is to create a gameplay that will keep players coming for more. By creating engaging gameplay, players will concurrently learn more about the content that is presented in the game. (Dickey, 2005; Mccall, 2016)

In Pre-Mortem, players may interact with surroundings in search of information to answer the questions about Surrealism. Surrealism is a literary and philosophical movement pioneered by André Breton which would spiral into an art movement. Surrealism contributes to the shortcomings of previous artwork and psychological thought by combining the unconscious and conscious mind to achieve hitherto impossible artistic creation and mental self-comprehension (Zhang, 2015).

Players need to think like a surrealist to solve the puzzle and get the answer to proceed to the next level. Besides that, digital games can tell stories and narrate on their own. Environmental storytelling is one of the storytelling methods that embed narrative information within their "mise-en-scène". By using this environmental storytelling method, the developer able to deliver narrative information, education, cultural preservation, or any form of message through the game. The narratives embedded with history content allow games to offer unique affordances to the audiences for re-enacting, replaying, and gaining experiences within the realms of history. So true adding interactive in games will lead to a positive impact on the motivation when the person undergoes the learning process.

Humans sometimes have an issue they cannot remember all the details on things they are searching for, but they could know it if they saw it. One of the major problems with learning history among students is their attitude; such as lazy to read, read but not able to memorize the facts, not interested in history subject, students interested but have to memorize too many facts and the teaching and learning which are not effective (Zhu, 2019).

Based on research done by Nate Gertsch and Joel Ossher, no date, humans' memory system has two kinds of memory storages; short-term memory (STM) and long-term memory (LTM). The procedural memory in LTM stores how the information of the procedure stored in the memory. It let us remember the steps necessary to perform an action and to repeat it. This memory allows people to perform common tasks without having to rediscover every action. This brings to the rote learning where a process of memorization of information based on repetition, recalls the meaning of the material.

Rote learning is a process of memorization of information based on repetition, which means one can quickly recall the meaning of the material by repeating it. Rote learning usually involves procedural memory, related to a long-term memory system that stores how the information of memory. This system allows humans to perform common tasks without having to rediscover every action (Mayer, 2016).

Meaningful learning is more complicated where one not only recalls the information, but one needs to understand the meaning of the information and make sense out of it. According to Mayer, 2016 there are six cognitive process categories; remember, understand, apply, analyzed, evaluate, and create. In this Pre-Mortem only three were discussed, which is remembered, understand, and apply.

III. GAME: PRE-MORTEM

Pre-Mortem is a digital game that targets university students. It aims to allow the player to interact with surroundings in search of information to answer the questions about Surrealism.

A research was conducted to determine the concept of the game. Four main points were determined to encourage the player to play the game and learn the topics regarding the basic idea of Art History, the contents that should be applied to the game and how to make it understandable by the audience.

A. Game Idea

The contents include the basic idea of Surrealism, paintings and the Surrealists. The content of the game mainly refers to

related literature of Art history and educational elements that contain information extracted from The Message of Surrealist Art by Dan Turkel. Two paintings that stated in the literature review will be included in the game.

In terms of delivering the contents, the game will focus on the storytelling method, essentially on environmental storytelling. The game uses the traditional narrative storytelling method, which involves dialogues and monologue, and also the environmental storytelling method will deliver the information through the interaction between players with the environment during the gameplay. The game would use a meaningful learning process where it will teach the player to understand the basic concept of the contents before proceed to the next gameplay. The game also features assistance for players to memorize the name of Surrealists and their paintings using executing cognitive processes.

B. Sketches and Design

This phase consists of producing rough ideas, planning the game design, producing sketches and storyboards depicting characters from the game in Figure 1, interface and player interaction possibilities, and some possible story elements. The design phase is one of the crucial processes to go through because it determines the visual appearance of the project. This determines whether it is aesthetically pleasing and interactive graphical representations are essential for the audiences or players to relate and immerse themselves in the game. All sketches helped to visualize different outcomes which will suit the aspect. All the sketch process was made directly in the digital form of drawing using a drawing tablet.

Figure 1. Character design of protagonist and antagonist

The game environment is divided into four locations the Bridge, the Gramophone Lake, from a painting named 'Persistence of Memories' and also includes another painting named 'Son of Man' as in Table 1. The storyboard helps to visualize the flow of the story in the game. There are two types of storyboard involves in building the game. First, screenplay storyboard, which is a traditional storyboard to visualize details and camera angle of the cut scenes in the game. While the other is, game storyboard, to visualize the flow of the game and the arrangement of the user interface during the gameplay.

Table 1. Pre-Mortem World

Pre-Mortem World	
Sub-Location	Details
The Bridge	Level 1 – Starting Point
The Gramophone Lake	Between each level
Persistence of Memory	Level 2
Son of Man	Level 3 – Final painting

C. Development

In the early section, to systematically manage the workflow of the development phase, the modified version Scrum software development model was utilized. This model arranges development into so-called "sprints", with each sprint concentrates on the development process of each game level.

Development starts with creating the game assets, including characters, environments, intractable objects, and miscellaneous, before implementation into the game engine. All these processes have been done using multiple software. Once the previous process completed, all the assets need to be compiled into the game engine. The next step is the visual scripting process. This game system is created through visual programming. All these processes are repeated until the development reaches the fourth sprint. During the fourth sprint, the development process starts with producing and editing cutscene videos. There is a few software used in this process, Adobe Premiere Pro and Sony Vegas 12. Both introduction and ending cutscene then compiled into the game engine. This process was pushed into the last sprint since the process is simpler compared to creating the gameplay. The complete game then exported into NodeWebkit.js and converted into a playable game.

D. Game Product

The project idea is about a puzzle-platformer video game called Pre-Mortem. The screenshot as shown in Figure 2. It tells the story of Grey Ackles, an Art Historian and a painter who wakes up in a surreal world where some part of the place seems familiar to him. He met with the antagonist which is the Gramophone and learns that he was stuck in a strange subconscious mind, his own mind, where he needs to solve the puzzle to regain his memory. The puzzle lies in two Surrealist paintings which are The Persistence of Memory and the Son of Man. Before he regains his memories, he needs to answer a question through the doors. He must enter the door with the right answer if his answer is not correct then, he will be stuck the world forever. After solving the puzzle, Grey learns that he was in a comatose state after he had an accident when trying to save a child from being struck by the bus when he was on his way home to celebrate his son's birthday. He has been given a second to get up from his comatose. At the ending part, he wakes up at the hospital and a few months later recover from his injury and painting his own surreal masterpiece, the Talking Gramophone.

This gameplay concentrates on side-scrolling, exploration, and puzzle-solving. With no time limits, the player needs to understand the concept of Surrealism, which is counter rationality and uses an irrational way to solve the puzzle, if not, the player will not be able to proceed to the next level. To assist the player in rememorizing the painting name and its painter, the game used both recognizing and recalling the cognitive process. Combined with a feature of question puzzle, a puzzle that simulated as exercise questions at the end of each level by making the player choose the door with the right answer to precede the game or they will be stuck in the current level, which is suitable with executing cognitive process.

The game is played from a side-scrolling perspective in real-time with the keyboard. The player controls the protagonist movements using the W, A, S, D keys, and interact with non-playable characters (NPCs) and the environment by pressing the E key to interact. On the second level, players allowed to do screen-wrap and do the trick to move around the obstacles.

Between each level, the player will encounter the stage where they will meet the antagonist of the game, the Gramophone Lake. The stage was designed based on a concept of dream-like fantasy, the world between conscious and unconscious. In this stage, the player needs to answer the question related to the topics by interacting with a correct door to proceed to the next level. If not successful, the player should repeat the stage in the same loop. This stage is a little bit confusing to some players if they could not answer correctly, several dialogues will be triggered based on player s' choices.

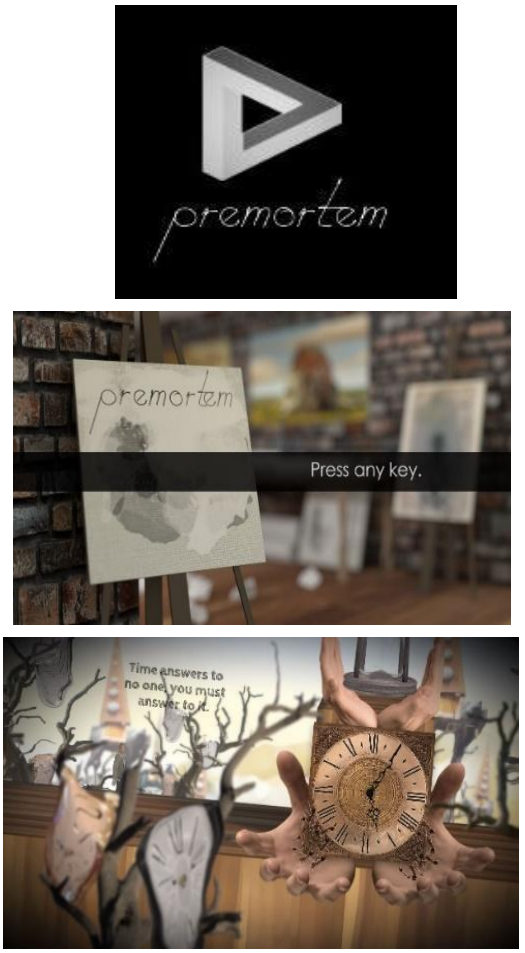

Figure 2. Finalized game logo, title screen, and Mid-level in-game screenshot

IV. EVALUATION

The main aim of this research was to test the Pre-Mortem usefulness of game design and to verify the education aspects of the game.

A. Evaluation Design

A quantitative study with 47 participants was tested using semi-structured questionnaires. The effectiveness of the game Pre-Mortem is quantified through 47 students who take the Graphic Design program at Management & Science University as our sample since they are the target users for the game.

B. Results

In the first part of the evaluation, a general question was measured. During the final part of the evaluation, the overall experience was measured with an aim to assess the content and satisfaction while playing the game. The following data was obtained and analyzed.

1. General Questions

Players spend an average of 1 to 5 hours per week and above on games. As illustrated in Figure 3, the result showed that game enthusiasts as twice as more interested to play the game compared to non-game enthusiasts.

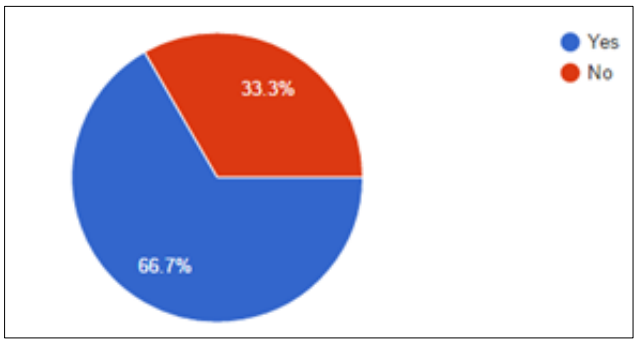

Figure 3. Comparison of interest in playing game

2. Overall Experience

Content delivery was successful since the majority of respondents able to understand the basic concept of the topic. Questions ask are:

Question 1: What is the basic idea of Surrealism?
Question 2: What is the name of the painting?
Question 3: He is one of the famous Surrealists. What is his name?
Question 4: Name the painting.
Question 5: What is the name of the painter?

They can recall the information used in long term memory, players giving full attention to the gameplay session and search for information. They were able to remember the information they were not tested on it in the game. This result as in Figure 4, strengthens that recognizing the cognition process succeeded.

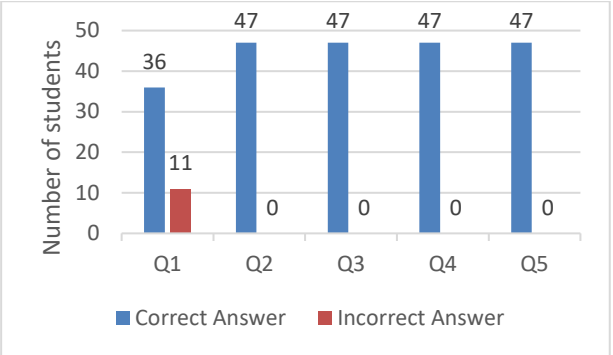

Figure 4. Students answer on the basic concept of the topic

Based on the results, players enjoyed playing the game. The players contributed full attention to the gameplay session and explored themselves for information.

C. Discussion

According to the findings of the evaluation, still, some people in the majority have difficulties in remembering historical facts as also stated by (Azan, Zin and Wong, 2014). Based on the result, Pre-Mortem received positive feedbacks from the majority of respondents, receiving 66.7% of respondents interested to finish the game. The conclusion was strengthening by the results obtained after the evaluation where the majority of 60% of people were interested in playing the game.

V. CONCLUSION

In this paper, the researcher reported findings of the factors to contribute to producing a game that would assist learning Art History based on the feedback on the content delivery regarding Surrealism in Art History, the controls, and how much the audiences have learned about the topic through the game. The evaluation showed that students enjoyed the digital game and results indicate that the game prototype Pre-Mortem can help improve the retention of learning in Art History. It was also found that the storytelling technique makes the game more attractive and engaging, and cognitive recognition techniques play a huge role in delivering the content.

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