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A Simulation Game to Diagnosing Major Depressive Disorder based on PHQ-9 for Psychiatrist Program in Thailand: An Evaluation of Game Interface Design and Prototype

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Abstract: Owing to the limited access to get diagnosed with Mental Depressive Disorder (MDD), people who get suffering from this illness are dramatically increasing in recent years. In Thailand university's psychiatrist program, prospective psychiatrists are required to support in-service psychiatrists diagnose patients with the interview. Concerned with the subjectivity issue, this process usually results in disappointed diagnosis; eventually, the patients encounter delayed treatment courses. With these considerations, this study attempts to address the before-mentioned flaws by proposing a simulation game to help the patients determine the level of MDD regardless of psychiatrists' subjectivity and long-waiting list matters. To be more personalized, this game is designed into three themes for different age groups. The mechanism of this game is based on diagnosing tools, and Patient Health Questionnaire-9. While playing on game scenarios, the users are automatically diagnosed; accordingly, the guideline for initial recovery is given. Before game development, this paper primarily presents the game interface which is designed to be simple and comfortable for the MDD patients and any persons. To evaluate the effectiveness of the proposed design, a game prototype on a teenage group is developed and examined by experienced psychiatrists on medical perspective, UX/UI experts on game design, and sample users on their attitudes. The findings of this study can serve not only as a foundation to develop the better game but also as an alternative learning tool for psychiatrist program.

Keywords: Educational game, game interface design, Major Depressive Disorder, medical education, psychiatrist program

1. Introduction

The definition of mental illness is an illness that affects directly to patient mindset (Cambridge English Dictionary, 2017). One of mental illness is a major depressive disorder which cases a lot of suicide case in the last year, 2017. The patients from all age range suffered from mental disorder and committed to suicide. We lost people nearly 800,000 per year due to suicide case which means people die in every 40 seconds every day because of depression (WHO, 2014). Depressive is a term of mental condition that patients are stated in a low mood and lost interest or lost appetite which effects to the patient daily life (Jan, Meng, Gaus, Zhang, & Turabzadeh, 2014).

In Thailand, more than one million people that suffer from the depressive disorder. Thai people commit suicide one person per two hours, and Thai's male has a high statistic of completed suicide more than female. In essential psychiatry diagnose course, there are three main steps which

psychiatry student must completely understand, first is the patient interviewing; to let the patients explain their mindset and experience to explore the cause of mental illness. The second is asking about history illness and behavior of patients. The last topic is a psychological test which has to proceed step by step to receive the accurate information from the patients. Those all above diagnose tool and step in Thailand is based a paper platform which deviates by a human error ("Department of Psychiatry, Faculty of Medicine Siriraj Hospital Mahidol University," n.d.; Somdet Chaopraya Institute of Psychiatry, n.d.; Wongpakaran N, 2009).

The game was used as a tool for learning. Nowadays game is one kind of medium that students in this generation familiar with and used to interact since their childhood. In a variety of subjects, the game was used in their class to support the learning skills of students. There are many benefits of using the game in education such as to increasing memory capacity, Strategic and problem solving or skill building; Map reading or language (OpenEducationEuropa, 2016; TeachThought Staff, 2017). Nowadays, we use a game application as a tool of diagnostics which still not becoming a great framework (Sajjadi, Vlieghe, & De Troyer, 2017).

Therefore, this paper aims to address the gap of diagnosing MDD patients or any people with the proposed game application. The game will help psychiatry students of Psychiatry and Advanced Clinical Psychiatry courses while practicing diagnosing the users with more time-effective and less subjectivity-concerned. In this phase of the study, game design was proposed and mainly presented; meanwhile, its evaluation has been conducted for further improvement. Therefore, the following research questions were formulated to direct this study:

1) What are the overall structure and mechanics of this game?

2) What are the flow and the design of the game interface?

3) What is the effectiveness of the proposed game design on content and satisfaction aspects?

2. Literature Review

2.1 Mental Disorder Diagnostics

A mental illness clinical procedure can be divided into three essential parts: Intelligence tests, Personality test and the presence of organic involvement test. In this paper, we will focus on the patient health questionnaire (PHQ-9) which is widely used for scanning the depressive disorder patients. Thai mental health department also concerned and recommend this questionnaire platform for the patient's self-scanning (Lotrakul, Sumrithe, & Saipanish, 2008).

As mentioned above, screening for Major depressive disorder in 9 questions. The nine questions contained about the symptoms in two weeks before interview: (1) depressed mood, (2) anhedonia, (3) sleep problems, (4) feeling of tiredness, (5) the change of appetite and weight, (6) feeling of guilty or worry, (7) concentrating, (8) feeling sluggishness or worry and (9) the suicidal idea. The PHQ-9 screening score can help the psychiatry generate the level of Major Depressive Disorder patient in 4 levels; rarely depressive, minor level of depressive, medium level of depressive and high level of depressive which create risk for suicidal ideation (Liu et al., 2016; Muñoz-Navarro et al., 2017; Suzuki, Kumei, Ohhira, Nozu, & Okumura, 2015).

Somehow the questionnaire from the interviewer may let the patient feel more pressure and an anxious that lead to the incorrect data collection. This paper will focus on using the media; Game as a medium for a friendlier user interface for patient and psychiatry student to collect the right information and planning for proper treatments for each case.

2.2 Game for Medical Education

There are many types of educational game which can improve the learning skills of learners in specific subjects (MikeD, 2014). The learners can enjoy an interaction of game unique interface and storytelling or platform. Many game mechanics theories were used to create a learner's skill training course. The learner has the freedom of exploring the contents of the game storytelling while learning new knowledge. Game-based learning can improve the learning outcome of learners while playing

is an activity of human learning fundamental. Moreover, the serious games were linked to education learning mechanics (Sajjadi et al., 2017).

In medical education, variety type of game become a part of learning tools such as a board game, web-based online quiz creator or simulation game for a specific subject such as microbiology, pathology. All of the platforms are focusing on the satisfaction of learner and the learning outcome which compared with passive learning; a class lecture with active learning; game education. The medical education game mechanic may force the user to solve the simulate danger situation; Save the patient's life. The user or student has to choose the right answer in time to save the patient's life or pass the quiz question. From these research studies, the game is not only a platform for entertaining but was developed for the active learning tool to motivate the learner (Education, 1998; Struwig, Beylefeld, & Joubert, 2014; World Federation for Medical Education, 2015).

From the above context, this paper will focus on developing the game media as a useful learning tool for psychiatry student. The objective of this game development is using the game as the medium between psychiatry and patient which is complicated and need the experience to diagnose the case.

2.3 User Interface of Game Design

Nowadays, game is not the tools for entertaining but is used as learning tools as well. Besides, the design of an interface can use to solve the problem of our daily life (Nakamura, Koyama, Sakamoto, & Igarashi, 2016). In education perspective, the game was used as the medium in the many subjects. The key of the game design is a user interface which can interact directly with users or players. In developing a game, the design has to be concerned with the following issues. First is simplicity; focusing on the basis which not confused or overloads information to the user. The next one is the key to visibility which is the feedback to provide useful information to the user. The last topic is the similarity which is the key to lead the user options to choose from. The last one is familiarity which is to let the user understand and recognize how to use the tool (Kevin Saunders, 2012). Game SAN or Simulation game of diagnosis of Coronary artery is the most related education game. The game aims to develop game interface design to support the communication of learner and subject contents. The result of the research which based on the principle of proper interface development shows that user satisfied and feel comfortable while learning through playing game SAN (Rahadiani, Ida, & Mardiono, 2012).

In this research will focus on developing the game interface design to create the simple interface based on theory above which made the user or the patient who participated in research feel more comfortable and open their mind about mental illness diagnosis especially the Major Depressive Disorder patient.

3. A Development of Game Interface Design and Prototype

In this paper, we focus on user experience and user interface design on game platform matching with the Patient Health Questionnaire-9 (PHQ-9). The expected result of this paper is to create a game to collect information of Major Depressive Disorder self-rating and generate a depression level. The patients will receive proper advice for further treatment. The patients in different age ranges will receive different themes of role-playing which concerned about their related life experience. From this point, this study expected that the proposed game would help psychiatrist students collect data from the patients who are not satisfied or not ready with the regular interviewing and counseling procedure.

From the points as mentioned earlier, this paper decides to create a game application-based learning tool. The theme of gameplay will generate three main themes which are divided by the patient's age range; children, teenage and elderly. The system will set the different background of theme story by choosing the most related experience from his/her age range. However, this study will mainly focus on game design for the teenage group.

3.1 Overall Game Structure

The application was developed for the psychiatry student and patient using as a tool for Major Depressive Disorder rating. The application uses the concept of flat design game as a theme to decrease the stress and provide the more comfortable platform. The game design was created by Adobe Illustrator which is suitable for creating flat design character and background, where the interactive design prototype was developed by Invision software; an online web application to create an interactive prototype.

As shown in Figure 1, overall structure displays about the flow of the application which also show the interaction between the user and the system. The system was created to support information management by collecting necessary information from the patient or user. Another vital role of the system is a tool for diagnosing for a depression level and giving the patients pieces of advice which lead to a proper treatment accordingly.

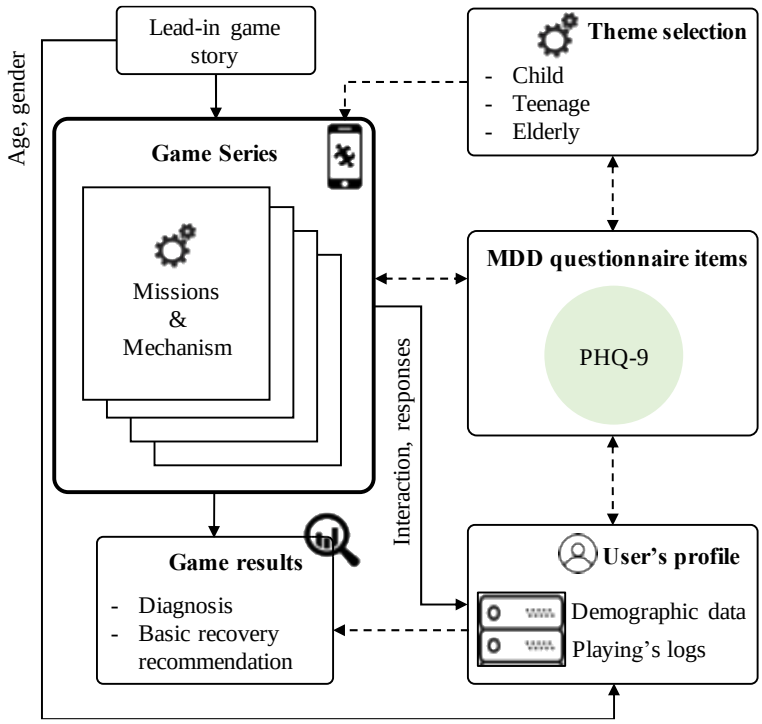


Figure 1. Overall Structure.

3.2 Game Flow

The game flow structure in Figure 2 displays the overall details of the proposed system. Starting with registration information; age and gender, to generate for the clinical term. The game system will select the theme automatically for the user from the age range; Child, Teenage and elderly. After register information, the user can select the situation or the map of the gameplay. In the next state is the gameplay which entertained the user and let user challenge by using the vivid flat design game; character and application background. The Player has to collect the coin to unlock the new story.

After the next state was unlocked, the system will encourage the user to answer the question about personal experience and ask to share the story of their own. This step was aimed to prepare the user to rate and analyze the mindset before doing the series PHQ-9 questionnaire. In the questionnaire series, the user has to choose the level of their emotion in each question which contained three level; Always, Sometimes and never. The score will collect and use to calculate the user depression level. The last important part is the Major Depressive Disorder screening result and analyze the result and give the user a recommendation for the user in each group.

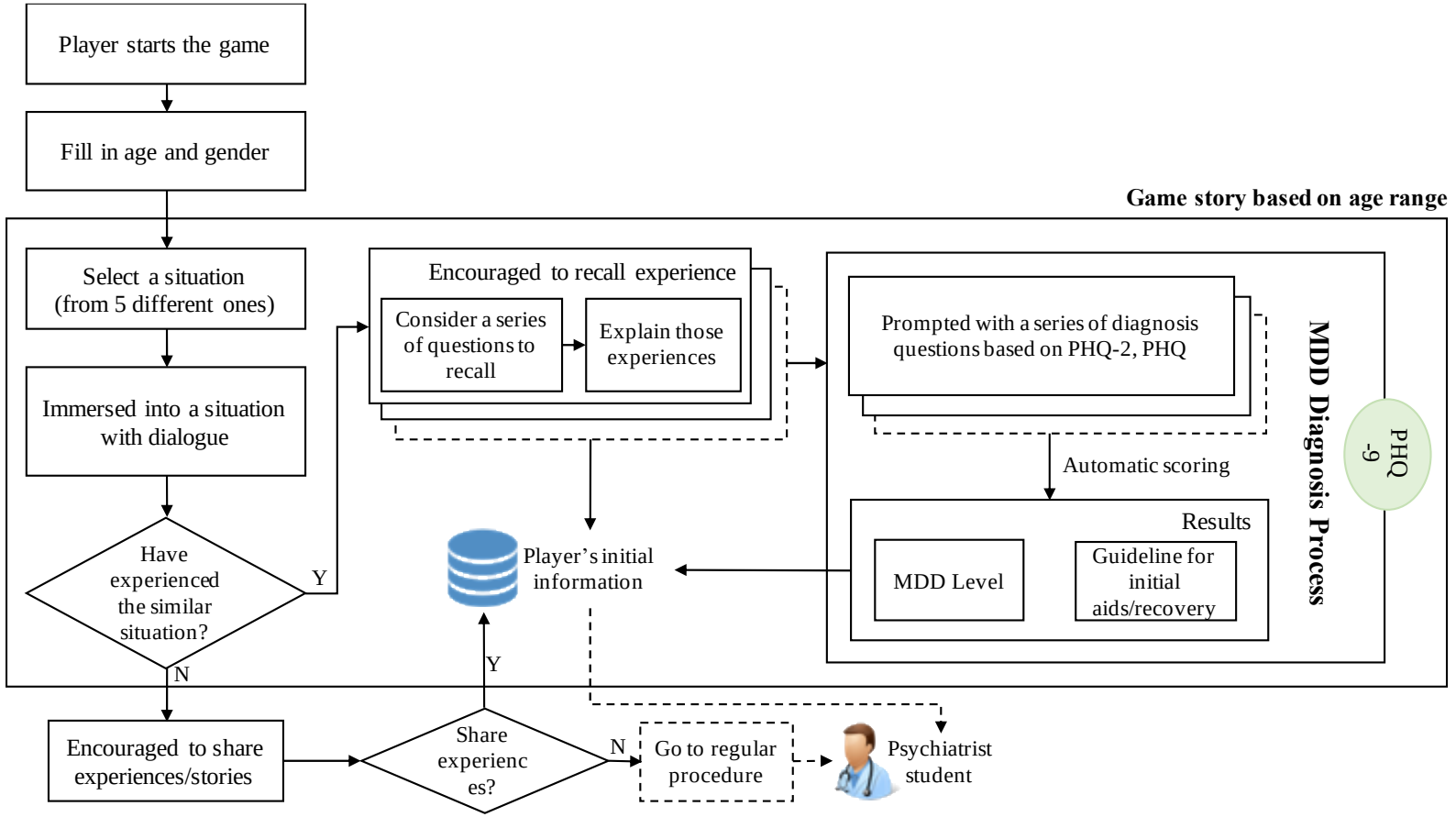
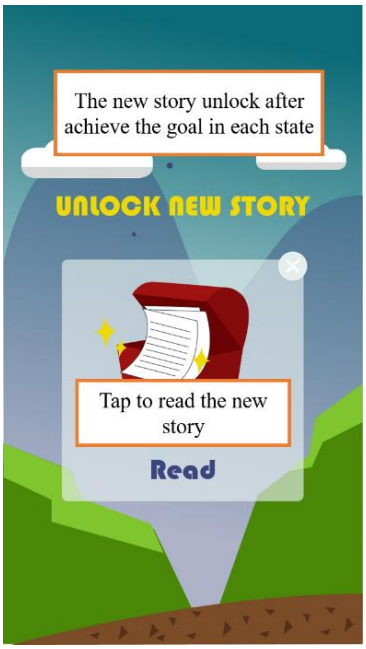


Figure 2. Game Flow.

3.3 Game Design and Prototype

The game prototype in Figure 3, the first page that interacts with the user is data collecting part which asks the user to identify personal information. After the login part and situation selection, the game application will lead to the gameplay interface, as shown in Figure 3 (a), User can press jump and fight button to collect the coin or against the enemies in each state. The coin that user had collect will show in the score bar in the top of the interface and the life of the user also shown as well in the heart shape. After achieving the mission, the system will lead to the unlock story page which represents in the treasure box in Figure 3 (b). From this state will lead to the questionnaire part which contained nine question series based on a PHQ-9 questionnaire. The interface will let the user rating the level of depression by the score bar, as shown in Figure 3 (c). After the self-rating interface, the system will generate the score of user depression which divides into three level; high, moderate and low which shown in Figure 3 (d).

(a) Lead-in story I



(b) Lead-in story II

(c) Diagnostic questions

(d) Diagnostic result and recommendation

Figure 3. Game Screenshots.

4. Evaluation & Results

After designing an interactive prototype on the teenage theme, a simple evaluation of the proposed game was conducted with an experienced psychiatrist and the sample users on two developed questionnaires.

The first questionnaire, for the psychiatrist evaluating the content validity (CV) of the game, consists of six five-point Likert Scale items and four open-ended questions. The second questionnaire was revised for evaluating game satisfaction (GS) by the samples drawn with the convenient sampling method towards interaction (GIA) and game user interface (GUI) dimensions in considering of simplicity, visibility, and similarity of the proposed game (Rahadiani et al., 2012). It includes six five-point Likert Scale items and three open-ended questions. These two questionnaires have been trial and edited before collecting data with the accepted internal consistency (Cronbach's alpha: CV = 0.76, GS = 0.84).

4.1 Content Validity

Based on the results of CV questionnaire, it was found that the psychiatrist rated the attitudes towards the content on game design were at medium level (M = 3.52, SD = 0.23); moreover, the psychiatrist provided qualitative attitudes and suggestions, as shown in Table 1. Based on this finding, it can be implied that the content represented on this version of the game design is appropriate for the targets, while the game activities for the high depression patients need to be improved for better motivation.

Table 1

Qualitative Results from the Psychiatrist

Attitude	Suggestion
- It's a creative tool with content matching. - It's impressive of using a symbolic to represent the depression. - The theme and the key content are creative and suitable for the targets.	- Reconceptualization brainstorm of platform for more effective. - The adventure game may hard to motivate the high depression patient.

4.2 Game Satisfaction

To further understand how the samples are satisfied with the proposed game design and prototype, the results of GS questionnaire were analyzed based on the dimension (Game Interaction: GIA, Graphic User Interface: GUI) and samples' confidence level (Low: LC, High: HC). It was found that the samples with high confidence level rated their satisfaction towards the game lower than those with low confidence on both dimensions. In the meantime, the former group gave the feedbacks by concentrating on game story and interaction to improve rather than the game theme and interface.

Therefore, based on these findings, the current version of game interface design, a game story and game interaction shall need to be improved to meet different target groups of MDD levels, which may prefer different game storylines.

Table 2

Satisfaction Results of Samples with Different Confidence Levels

Dimension	Group	$M \pm SD$	Interpretation	Feedback
GIA	LC	3.73 ± 0.72	Med	- Confusing about game theme and self-rating interface.
	HC	2.40 ± 0.54	Low	- Add more complex story based telling and some interaction feature.
GUI	LC	4.44 ± 0.17	High	- Adding more instruction of game guideline. - Cute interface can theme color which attractive to user.

	HC	3.00 ± 0.47	Med	- Impressive idea concept and friendly user interface. - The lead-in game play and stress rating interface can improve. - The interface is suitable for age range and impressive theme color but can improve overview concept.

5. Conclusion

This study aims to address the subjectivity concern of mental illness patients, namely MDD on getting screening diagnostics with psychiatrist students' interview procedure; therefore, the game has been proposed to address the issue mentioned above. Before developing the game, game design and interface were essentially presented in this paper; while the game prototype was developed for the initial evaluation. The game has been designed with two main considerations which are content validity and game satisfaction. Based on the evaluation results, it was found that this version of game design needs to undergo a substantial improvement. In addition to that, the contribution of this proposed game would go for the university's psychiatry program and general use of any people.

However, to better improve this game before the development, a game storyline should be reconsidered to motivate all levels of MDD patients. A game interaction should be more user-friendly to avoid incorrect responses from the users. Moreover, a user interface of the game can be improved on two aspects. Each game question can be separated into different pages to gain the direct attention from the user with the relevant game scenario; meanwhile the rating scale can be adjusted to maximize the user experience.

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