EMOGAME: Digital Games Therapy for Older Adults

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***Abstract*—EmoGame is a cognitive and emotional game useful for helping older adults who experience Mild Cognitive Impairment (MCI). EmoGame was developed with a memory therapy approach. This therapy can help cognitive and positive emotions and introduce objects through pictures, such as pictures of old objects and old music in old age. This study aims to build a game application for MCI older adults on the Android platform to support improved cognitive abilities and positive emotions for older adults. This app has two games which are memory puzzle and memory exploration. This study uses a mixture of quantitative and qualitative methods through data collection questionnaires, diary entries 3E (Expressing, Experiences and Emotions), and interviews. Respondents were selected aged 50 years and above through the Mini-Mental State Examination (MMSE). The findings found that memory therapy can help older adults increase positive emotions through digital games. Through diary entries and Diary 3E, respondents' feelings and experiences described positive emotions (happy, smile and like). The PANAS questionnaire (Positive and Negative Affect Schedule) was conducted for pre and post-testing to find positive emotions in EmoGame. Analysis of mean scores showed positive emotional factors at pre-interaction (M = 3.39, SD = 0.89) with post-interaction levels of positive emotions (M = 4.02, SD = 0.97), meaning there were significant differences in positive emotions of the older adults. The memory therapy applied in the EmoGame app is effective in helping to reduce the problem of memory decline and positive emotions for MCI older adults.**

Keywords*—Digital games; therapy; older adults; mild cognitive impairment

I. Introduction

A game is an electronic entertainment consisting of two elements, namely visual and audio. Games have many types, one of which is games for older adults. Games for older adults are made with a specific purpose to help the older adults train their minds. In the era of globalization, technological progress is developing so rapidly—one of these technological advances in information technology has given much goodness to human life. The health sector does not lag in integrating information technology and is developing so rapidly that many discoveries are being made. Information technology is also influencing changes in health services in the world to meet the needs of its practitioners, including older adults. Among the changes and advances that have taken place is information technology to solve various health problems, especially among older adults who suffer from mild cognitive impairment [28]. Mild Cognitive Impairment (MCI) will affect the way older adults think, behave, and do their regular daily work. Brain function will be disrupted, causing the older adult who suffers from it to face the problem of disorders in socialization and work. The initial symptom of mild cognitive decline is that the older adult will experience an inability to perform daily activities due to the reduction in cognitive abilities experienced by the older adults [3].

Alzheimer's (AD) has become a severe health problem in society and has resulted in tremendous economic loss and social burden. By 2030 there will be 66 million people with Alzheimer's worldwide, and the number is likely to reach as many as 115 million people by 2050 [27] Before a person develops Alzheimer's, they will experience a cognitive decline called mild cognitive impairment (MCI). Something scary is that this cognitive decline can happen unnoticed. Alzheimer's in its early stages can act like most normal people. Seniors with mild cognitive impairment have a high risk of developing dementia at a percentage level of 10% to 15% per year. Cognitive impairment in older adults can be associated with the normal ageing process, or they may begin to experience symptoms of memory decline in the early stages. Memory changes affect the daily lives of older adults, such as difficulty receiving information, remembering, difficulty speaking, not understanding information, inability to comprehend movement space, inability to assess, and difficulty in paying attention [1]. Individuals with mild cognitive impairment are also more likely to have difficulty coping with questions and controlling their emotions. It is possible that they also experience personality changes. In addition, older adults who experience memory changes will also experience changes in social roles, family, feelings of shame, emotions, feelings of burden, frustration with memory problems resulting in loss of self-confidence and constant anxiety [2]. At an advanced age, emotions play a significant role in determining an individual's attitudes. Therefore, it is necessary to do mental preparation in managing emotions because a person at an advanced age is highly likely to experience changes and emotional decline, thus interfering with memory problems. Based on studies that have been done [5], seniors tend to show less stable and uncontrolled emotions. Feelings of anger occur due to negative thoughts that exist about something. To cope with the burden or stress experienced, positive emotional changes, especially among older adults, are essential [9].

Currently, therapy has been found to help older adults with mild cognitive impairment. According to Mosby's medical dictionary [7], therapy is defined as a rehabilitative treatment on a patient who has ever had any disease or experienced something. Therapeutic methods can help the problems and disabilities of older adults achieve cognitive, emotional and social development. In addition, the role of the game is one of the media that provides an atmosphere of thinking where the

player follows the set rules and strives to complete the game by following the rules. Games are an excellent technique for motivating players to understand concepts that are considered boring and use their minds [6]. One of the technological developments includes gerontechnology, which aims to apply technology that addresses the problems and difficulties arising from the symptoms of ageing so that seniors can use technology for a healthier and more independent life and can engage in social relationships [11]. Therefore, the solution from therapeutic technology is seen to help reduce the problem and improve emotional stability among older adults. This situation is in line with the increasing development of technology in the future, especially in health. Technology is seen to be able to enhance the impact of positive change. Game technology combined with therapy is proposed to increase positive emotions, especially among older adults [24]. This study aims to represent EmoGame as a therapy for older adults with Mild Cognitive Impairment.

II. Background Study

A. Digital Games

Digital games mean interactive games for computers or computerized game machines requiring acting skills and play strategies. Players typically play using a selector device such as a projector, trackball, or buttons to control graphic display objects [10]. According to [30], digital gaming is entertainment that requires players to interact directly with a user interface on a screen or monitor using an electronic device. Most digital games provide in-game challenges that occur narratively with several pre-defined rules. Players are placed in competition to face obstacles on their own or with other players to succeed in the game [26]. Many media reports in digital gaming studies discuss the positive or negative effects of digital gaming activities on society.

Several studies attempt to generally examine whether digital gaming is a healthy activity or vice versa. Nevertheless, it is unfair to conclude whether digital games have a good or bad effect. Studies show that the effects of digital games are complex, unclear, and vary, depending on the context of the game and the player itself [16]. If one looks at the history of studies on the effects of other media, such as watching television, it has also produced similarly complex and vague results [22]. The following section will discuss research showing positive and negative effects on digital games to offset the complexity in considering the possible effects of digital games. Several studies show that digital games have had a positive impact on gamers in a familiar context or when used to achieve a specific purpose. These include the benefits of using games in specific contexts, such as education and healthcare, positively affecting cognitive skills, improving hand-eye coordination, and encouraging physical activity [20].

B. Aging and the Aging Process

Older adults refer to individuals over the age of 50 based on the aged standard set by the UN on ageing [17]. However, the World Health Organization (WHO), in its Aging Policy Framework published in [19], argues that age chronologically cannot be considered an accurate marker for physiological changes in the ageing process. There are many variations in older adults' health status and quality of life. However, no matter how old an individual is, one thing is for sure is that the older adults' population is increasing over time, given the increased chances of survival and decreasing fertility rates. This group is categorized as older adults through the ageing process [25].

The ageing process can lower cognitive ability, chronic health problems and memory loss. Cognitive is a process of thought patterns that continually causes us to be alert or perceive something, covering all aspects of observation, thought, and memory. The phenomenon has led to a decline in cognitive function among older individuals, especially older adults. The process of healthy, fruitful, sensible and positive ageing are general terms that refer to the process of optimizing opportunities for health, participation and security in order to improve quality of life with age and enable them to realize the potential to earn physical, social and mental well-being in life [23]. However, the factors leading to the re-emergence of mental and emotional health resulting from memory changes in individuals, especially relatively older adults, remain little changed [14].

C. Reminiscence Therapy for the Older Adults

Reminiscence therapy is the desired process of recalling memories. Reminiscence therapy can be an event that may not be memorable or an event that has been forgotten directly experienced by the individual. Memory therapy (Reminiscence) can be a collection of personal experiences or "sharing" with others. [21] defines memory therapy (Reminiscence) as the process of cognitive recall of past events and experiences. [28] explains that memory therapy (Reminiscence) is a therapy in older adults who are encouraged (motivated) to discuss past events, identify the problem-solving skills and get positive emotions. According to [18], memory therapy (Reminiscence) aims to enhance positive, cognitive emotions and help individuals achieve self-awareness and understanding, adapt to stress and see their part in historical and cultural contexts. Reminiscence therapy also aims to create group togetherness and increase social intimacy. [15] stated that memory therapy (Reminiscence) aims to provide a pleasant experience to improve quality of life and improve socialization and relationships with others, provide cognitive stimulation, improve communication, and be an effective therapy for emotional symptoms get positive emotions. According to [29], memory therapy (Reminiscence) aims to increase self-esteem and increase self-esteem. Feeling worthless helps achieve self -awareness improves stress-coping skills by practising past problem-solving skills and improving social relationships.

D. Technology for the Older Adults

In the older adults a large number of studies have proven that the use of assistive technology and information communication technology in particular is able to address the effects of changes in physical, cognitive and social aspects as a result of the aging process. The use of assistive technology and information technology has great potential to induce positive emotional growth in the social environment of the older adults. The use of information and communication technology today is an aid tool in our lives and its use is also growing rapidly in the

field of health. Technology nowadays is the best tool that can be used to help the older adults. Previous studies have shown that the use of assistive technology and information communication technology has the potential to provide opportunities for older adults to increase their life satisfaction and in turn reduce the burden of health care payments (Auriane et al. 2016).

TABLE I. TECHNOLOGY GAMES OLDER ADULTS MILD COGNITIVE IMPAIRMENT

Author	Games and Technology used	Age Group	Findings
Suwicha Jirayucharoensa, (2019)	Nuerofeedback (computer)	50-74	Attention and Memory
Gorge Savulich (2017)	Games (IPAD)	51-64	Motivation and Confidencei
Gabriel Olievera (2017)	Egocentric Image (Ipad)	50 keatas	Memory
Nursyairah Azman (2017)	Dance game (computer)	50-80	Health
Karsten Gielis, (2017)	Card	55	Memory
Costas Boletsis (2016)	Smartkuber (Touch Screen)	Above 52	Motivation
Valeria Manera (2015)	Cooking games	50-84	Memory
Kim (2015)	Music Games	50	Memory Episodic
Stefani Fazi (2014)	Home interaction game (3D virtual reality)	50	Memory and motivation
Miradidic (2014)	DMS 48 (Object Image)	50-65	Memory
TF Hughes (2014)	Wii sports games (computer)	50-70	Health
Ballesteros (2014)	Lumosity	50	Processing speed, Attention, and episodic Memory
Dannhauser (2014)	Lumosity	50	Memory
Stelios Zygourisa (2014)	Supermarket (virtual reality)	50	Motivation
JA Anguera (2013)	Games Neuro Racer	50-85	Attention and Memory
Anguera (2013)	Neuro-racer	50	Attention and Memory
Franco (2013)	Ninetendo wii fit for all	50	Memory
Man (2012)	Supermarket (virtual reality)	50	Memory
Rosen (2011)	Bowling (virtual reality)	50	Memory
Finn (2011)	Lumosity	50	Attention
Elizabeth H.Weybright (2010)	Nintendo	50-55	Memory
Stavros (2010)	Lumosity	50	Attention and memory
Bisson (2007)	Ball juggling	54	Health
Dustman (1992)	Games race (computer)	55	Memory speed reaction

The development of technological advances especially in game technology can help older adults who face symptoms of disability or mild cognitive impairment in training cognitive function. Nevertheless, studies on game technology to help mild cognitive impairment symptoms still need to be developed (George et al. 2017). Therefore, significant planning is needed to design technological game interfaces to support the skills and abilities of individuals who are going through the aging process especially the older adults.

From the existing literature review as shown in Table I, there are still few games using a reminiscence therapy approach to help cognitive and emotional. Therefore, the work was carried out in developing EmoGame application to support older adults with mild cognitive impairment problems.

III. METHODOLOGY

A. Participant

Twenty participants were categorized as MCI with the Mini-mental state examination (MMSE) test. The participants were recruited in a selected nursing home. The age group of participants is 50 years and older. We believe that this number of participants is considered significant for research trials like other studies [12], [13,4] The user study took two weeks. They were using the EmoGame app. Participants were given a 3E Diary and activity diary to evaluate the application and perform pre and post-play.

B. Procedure

We work directly with the participants to explain the research steps to be performed. The study will be conducted for two weeks. The first step taken by the researcher is to screen the study participants for their level of readiness to use the technology by using a questionnaire. Selected study participants will answer a Mini-Mental State Examination (MMSE) questionnaire to identify older adults with MCI.

Based on the results of the MMSE, a total of 20 respondents have been selected to participate in the study. The study participants were asked to fill in an activity diary in the first week. This diary aims to find about activities, technology, and how participants feel while doing daily activities. As a friendly reminder, for each study participant to fill in the daily activity diary, we will call and send a short message via Short Message Service (SMS). Participants were asked to record their daily activities in a written diary. Then in the second week, the participants will be asked to play the EmoGame application, and the participants are given the 3E (Expressing, Experiences and Emotions) Diary book. The purpose of giving this 3E Diary book is for participants to write about their feelings while playing the EmoGame game. Next, participants will be asked to fill in the Positive and Negative Effect Scale (PANAS) questionnaire and the System Usability Scale (SUS) questionnaire. Then the respondent will be asked to take the Mini-Mental State Examination (MMSE). The aim was to see if there was an increase in the level of cognitive ability of the respondents after undergoing memory or emotional therapy game training. After that, interviews will be conducted with older adults and experts to assess the effectiveness of cognitive or emotional therapy on study participants.

C. Games Application Development

We conducted interviews with older adults psychologists to get more insight. Based on the interviews, we found that memory therapy (Reminiscence) or emotion is excellent for developing positive emotions in an individual, especially among older adults. This statement is supported by the results of a study conducted by [8], who put forward the opinion that memory therapy (Reminiscence) is a process that is desired or not required to collect one's memories in the past. This means, memory therapy (Reminiscence) is a therapy, individuals will be encouraged or motivated to remember events in the past that helped create positive emotions.

D. Game Concept

The games developed are in the form of puzzle games, explorations of memories and musical melodies of memories, and pictures of old objects with nostalgia elements. We chose memory puzzles, memory exploration, and memory music because all of these things are easy to understand, especially for seniors. In addition, researchers argue that puzzle games, exploration of memories and musical melodies of memories, and pictures of old objects that have elements of nostalgia can attract the attention of the elderly and help create positive emotions in them. The game is made using two applications: Photoshop CS3 to create characters of old objects and cartoon characters and Unity 3D to compose the game patterns and graphics selected are 3D graphics. Next, we used Java SDK ver. 8 to support API (Application Programming Interface) while Android SDK rev. 21 is used for application development. Programming language: C# is used for game language programming. EmoGame app is an android-based game with a system of remembering the past that can contribute to the older adults MCI as an alternative medium to help improve cognitive and positive emotions.

EmoGame application is divided into four levels; the first is the Mini-Mental State Examination (MMSE) which serves to screen and identify seniors with mild cognitive impairment, while the second is the development of memory puzzle games. Memory puzzle games module are conceptualized puzzle games that use cards and are believed to improve a person's cognitive and emotional memory. A memory exploration game module with the concept of a village house has several parts of the house. The user will explore the village house and find old objects and reflective elements that can be navigated. Memories music was also used in the development of EmoGame. Through the music of memories, older adults can listen to memories, which are expected to give peace to their minds and emotions.

E. Research Framework

The research framework in Fig. 1 describes how the game is made and begins with the pre-production stage, where it prepares all the data to be used in the design, hardware requirements, software, flowcharts and storyboards. Then, the object is edited at the production stage, and the desired concept is applied via the method. The last step is the stage of testing and building the application into an application for Android and performing display testing, device testing, and testing.

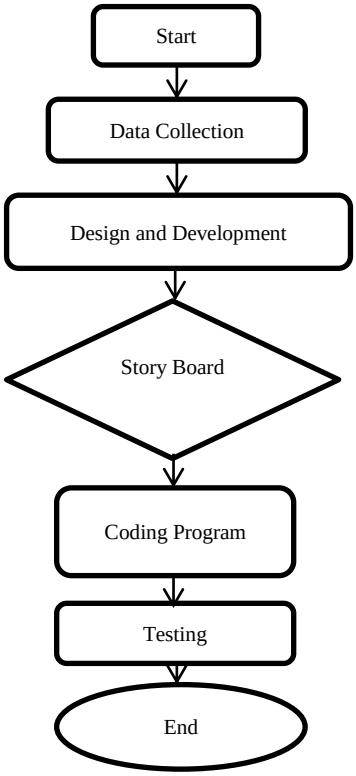

Fig. 1. Research Framework.

F. Application Interface

The screen interfaces of the developed application are shown in below.

1) Home page: Starting from the main menu, the user will enter the main page. To start the game, the user clicks the start button (Fig. 2).

Fig. 2. EmoGame Home Page.

2) Mini-Mental State Examination (MMSE): Mini-Mental State Examination is used as a tool to detect the presence of cognitive impairment in a person/individual (Fig. 3).

Fig. 3. Mini Mental State Examination Page.

3) Game puzzle memories: Players of the memory puzzle game are presented with cards and open the picture, then find the same picture. If the card is open, it will go to the next game (Fig. 4).

Fig. 4. Games Puzzle Memories Page.

4) Game exploration of memories: A game of memory exploration exploring the village house and remembering the pictures which are in the house (Fig. 5).

Fig. 5. Games Exploration of Memories Page.

5) Music of memories: Music memories players can listen to music if they do not want to play (Fig. 6).

Fig. 6. Memory Music Page.

IV. Findings

This section describes the cognitive findings, positive emotions and user experience when using the EmoGame application. Findings are presented before and after using the EmoGame application. The results are further divided into several separate sections for emotional and cognitive. Table II summarizes the demographic data of the participants. A total of twenty respondents consisted of older adults with MCI.

TABLE II. Demographic Data of Participants

Demographic		**No. (N)**
Age	50 years and older	20
Citizen	Indonesian	20
Level of education	Primary school Diploma Degree	- 11 9

A. Mini Mental State Examination

The Mini-Mental State Examination (MMSE) results showed that 20 respondents suffered from MCI. Mini-mental state examination (MMSE) is a cognitive examination that is part of a routine examination to establish a diagnosis of dementia. This examination is indicated especially in elderly patients who have decreased cognitive function, thinking ability, and ability to perform daily activities. A mini-mental state examination (MMSE) is done by direct interviews with patients. The patient will be questioned and asked to follow the instructions. Of the 52 respondents tested using the Mini-mental state examination, 20 respondents experienced MCI based on the MCI score criteria. The MMSE is an examination consisting of 11 assessment items used to assess attention and orientation, memory, registration, recall, calculation, language skills, and the ability to draw complex polygons. MMSE value total scores range: Severe (0-9), Moderate (10-17), MCI (18-26) and Normal (27-30). The results obtained from 20 respondents have a score of 3 respondents with a score 18, 3 respondents with a score of 19, 4 respondents with a score of 20, 2 respondents with score 21, 3 respondents with a score 22, 3 respondents with score 24 and 2 respondents score 25. These 20 respondents were selected. Table III below shows the categories of levels of Mild Cognitive Impairment among the older adults who were selected to be in the study sample.

TABLE III. Mini-Mental Examination (MMSE) Test Scores of Study Participants

No	**Study Participant Code (Respondent)**	**Score (MMSE)**
1	R1	18
2	R2	18
3	R3	18
4	R4	19
5	R5	19
6	R6	19
7	R7	20
8	R8	20
9	R9	20
10	R10	20
11	R11	21
12	R12	21
13	R13	22
14	R14	22
15	R15	22
16	R16	24
17	R17	24
18	R18	24
19	R19	25
20	R20	25

B. The Positive and Negative Affect Schedule (PANAS)

The Positive and Negative Affect Schedule (PANAS) which aims to look at how the emotional state among the elderly who are study participants. There are 20 PANAS questionnaire questions, ten positive PANAS questionnaire questions and ten negative PANAS questionnaire questions. Pre results in Fig. 7 and in Fig. 9 Pre and Post Analysis of EmoGame play is shown.

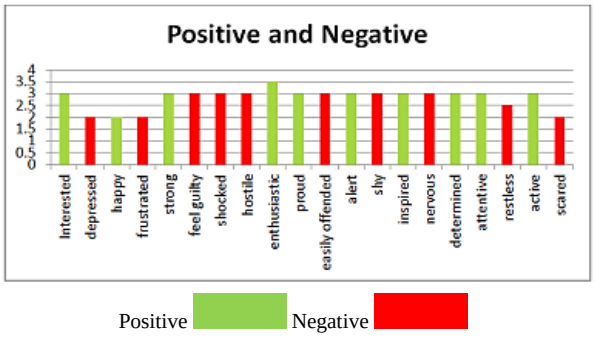

Fig. 7. Pre – Results Play EmoGame Application.

The study results at the pre-play stage mean positive effect values: attracted 3.5, happy 3.6, strong 2.8, enthusiastic 3.8, proud 3.4, alert 2.9, inspired 3.5, determined 3.4, attentive 3.6 and active 3.4. At the same time, post-play negative values mean showed depressed 2.0, frustrated 2.4. feeling guilty 2.7, shocked 2.7, hostile 2.6, easily offended 2.8, embarrassed 2.9, nervous 2.7, restless 2.6 and afraid 2.4. The following PANAS result after playing EmoGame (Fig. 8).

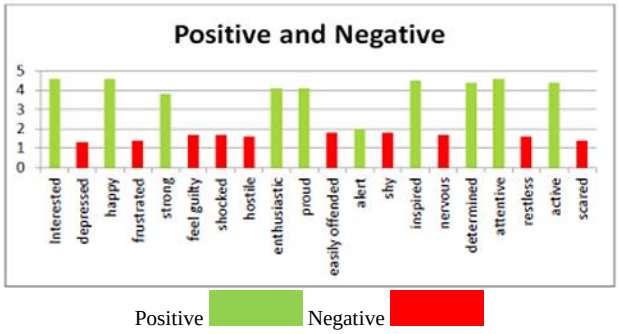

Fig. 8. Post – Results Play EmoGame Application.

The research results at the post-play stage the average value of positive emotions showed that the items were interested in playing 4.6, then happy 4.6, strong 3.8, enthusiastic 4.8, proud 4.1, alert 2.0, inspired 4.5, determined 4.4, attentive 4.6, active 4.4. Post-play positive emotions mean values showed depressed items at a value of 1.3, frustrated 1.4, guilty 1.7, shocked 1.7, hostile 1.6, easily offended 1.8, embarrassed 1.9, nervous 1.7, anxious 1.6 and afraid 1.4. Overall, the study results showed a significant difference between pre and post-play based on the results obtained from positive emotions pre with a mean value of 3 while post with a mean value of 4, for pre-negative emotions with a mean value of 2 while post with a mean value of 1. Researchers also measured the differences between two groups of pre and post paired data on an ordinal scale or interval so that the data obtained is more accurate. Here are pre and postpositive emotions (Fig. 9).

		N	Mean Rank	Sum of Ranks
Pasca_Bermain - Pra_Bermain	Negative Ranks	1[a]	1.50	1.50
	Positive Ranks	9[b]	5.94	53.50
	Ties	0[c]		
	Total	10		

Fig. 9. Pre and Post-Play EmoGame.

The result obtained is negative rank 1. This level indicates that there is no decrease from pre-play to post-play. The next positive rank is the sample with the value of the second group (post-play) being higher than the value of the first group (pre-play); there are 9 data positive ranks. This means nine positive emotions are on the rise. Mean ranks are average at a negative level of 1.50, while the sum of ranks is at a value of 1.50 and positive ranks are 5.94, and the sum of ranks is 53.50, which means there is an increase from pre and post play. Then ties are the value of the second group (post-play) 0, which means there is a difference, and N is the total of pre and postpositive emotions consisting of 10 positive emotions. Next, the researcher performed an analysis. Analysis of mean scores showed positive emotional factors at pre-interaction (M = 3.39, SD = 0.89) with post-interaction levels of positive emotions (M = 4.02, SD = 0.97). The conclusions obtained as a result of the analysis prove an increase in positive emotions after playing the game EmoGame application.

C. Activity Diary

The study using diaries was conducted based on the method proposed by Jacelon and Imperio (2005). Thematic analysis was used to analyze the diaries and review the data collected from all study participants. Briefly, the researchers have done some of these analyzes: (i) Creating a sub-theme of spirituality and entertainment under the theme of Daily Activities, (ii) Creating a new theme, i.e. Social theme. Several themes are obtained by using a diary before playing. This diary aims to capture the results of daily activities, emotions, and the use of technology. Fig. 10 shows the theme Analysis.

From the diary results, spirituality is something that older adults must do. Older adults can then use technology like they use Youtube or Facebook. With technology, older adults can avoid negative emotions such as loneliness, irritability, sadness, forgetfulness in their daily activities. This is a severe problem in older adults with MCI.

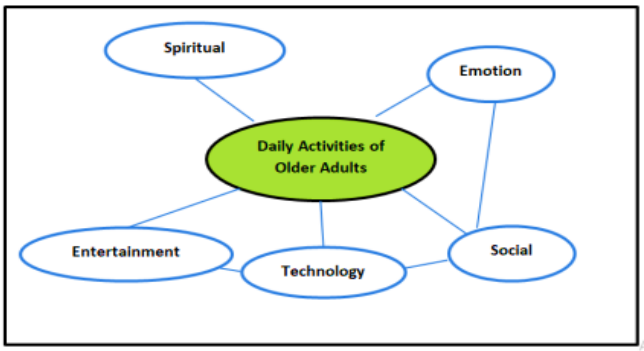

Fig. 10. Theme Analysis of Activity Diary.

D. 3 E Diary

A study found in the 3E diary discovered several related to the emotions of happiness, liking, pride, and excitement with the EmoGame app. Thematic visual maps describing the emotions of seniors involved in using EmoGame. Fig. 11 shows the Theme Analysis 3E Diary.

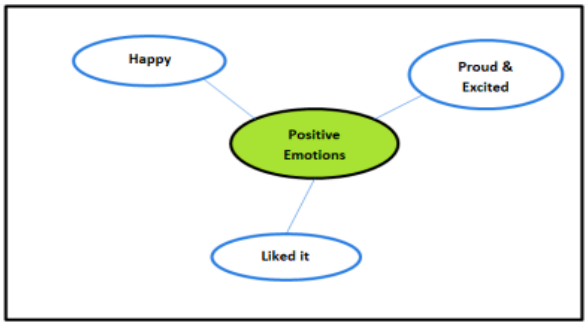

Fig. 11. Theme Analysis of 3E Diary.

Fig. 11 shows a thematic map showing the emotions involved in an EmoGame application. The thematic maps in the figure above are related to three themes of positive emotions while playing the EmoGame application obtained based on Diary 3E book data analysis. An explanation of the relevant emotional themes will be discussed as follows:

1) Happy: Emotions of joy were widely shared in Diary 3E by study participants. They stated that they wanted to play again and felt happy to play. The researchers hope that this game can help create a feeling of joy among older adults. The following are some of the posts that have been shared:

"I feel happy playing this game." (Diary R3)

“Happy and smiling to see the pictures and music in this game” (Diary R11).

Based on the notes or reports found in the 3E Diary it is clear that the EmoGame application is trendy among older adults and managed to create positive feelings and a sense of joy among them.

2) Liking: Positive emotion is defined as the user's interest or tendency to continue using the application (Charles, 2019). For seniors, the feeling of liking the game is an essential aspect. There were study participants who stated that they liked the EmoGame application. For example, there were study participants who consisted of older adults writing about their feelings of liking and interest in the EmoGame application as stated in the Diary 3E book entry:

"This game is exciting and easy to use. It is also fun to use” (Diary R4)

"Fun to use, very interesting" (Diary R9)

"I will play every day. I love this game" (Diary R11)

Although study participants in the early stages considered the EmoGame application difficult, that perception changed after playing it.

3) Proud and excited: The theme of Pride and Excitement is an emotion that is a sense of satisfaction resulting from obtaining a particular achievement (Chaplin., 2013). Based on the codes transcribed from the study participants' notes found in Diary 3E, older adults are excited about using gaming applications that provide new experiences using technology, thus creating a feeling of excitement among older adults. They also take pride in the easy to operate EmoGame application they provide. Examples of notes from study participants who used the EmoGame application that showed proud and excited emotions are as follows:

"The first time playing a game using a tablet is still a bit confusing, but I can play it" (Diary R3).

"Just have experience using tablets. After playing, I am very proud to play this game, I am thrilled. " (Diary R4).

"I have started to be able to use this tablet, and I am good at playing." (Diary R16).

E. System Usability Scale (SUS)

Based on the results of user satisfaction using the application, it is found that the value given is an average of 82. Fig. 12 is as follows.

The evaluation results conclude that there is an overall value of 82, meaning that this EmoGame application is excellent and able to train the memory of older adults who suffer from Mild Cognitive Impairment.

F. Cognitive Analysis

Mini-mental state examination is carried out Pre and Post playing EmoGame. This research aims to find out the cognition of older adults. The test results using Wiloxcon analysis and SPSS 2.0 can be seen in Fig. 13.

Calculate Result Score										Amount	Score (Amount x 2.5)
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10		
5	1	5	1	5	1	5	1	5	1	30	75
5	2	5	2	5	1	5	1	5	1	32	80
5	2	5	4	5	1	5	1	5	2	35	88
4	2	5	1	5	1	4	1	5	1	29	73
4	2	5	5	5	2	5	1	2	1	32	80
5	1	5	1	4	1	5	2	4	2	30	75
5	2	5	1	5	2	5	1	5	1	32	80
5	1	4	2	5	2	5	1	5	1	31	78
5	1	5	2	4	2	4	1	5	2	31	78
5	1	4	1	5	1	5	2	5	2	31	78
5	1	5	4	5	2	4	1	5	2	34	85
5	2	5	2	5	2	5	1	5	2	34	85
5	1	5	1	5	1	5	1	5	1	30	75
5	2	5	2	4	3	5	2	4	4	36	90
4	2	4	2	4	2	4	3	5	5	35	88
4	2	4	3	4	2	4	2	4	3	32	80
4	2	5	3	5	2	4	2	4	5	36	90
4	3	4	3	4	3	4	3	4	4	36	90
4	2	5	2	5	2	5	2	4	4	35	88
4	2	5	2	4	2	4	2	4	4	33	83
Average Score (Final Result)											82

Fig. 12. System Usability Score (SUS).

Ranks

		N	Mean Rank	Sum of Ranks
Post Test - Pre Test	Negative Ranks	0[a]	,00	,00
	Positive Ranks	22[b]	11,50	253,00
	Ties	0[c]		
Total		20		

Fig. 13. Mini-Mental State Examination Pre and Post Test Results.

The study results based on the Wiloxcon test clearly show that the negative ranks or negative difference between the results Pre and Post finishing playing the EmoGame application game is 0, whether it is at the value of N, mean, or sum rank. A value of 0 indicates no decrease from the pre-test and post-test values. The positive rank between results before and after play shows 20 positive N data which proves that there is a change among seniors before and after finishing playing the EmoGame application game with an increase of 11.50, while the total positive rank or sum of rank is 253.00. There is an equality value of ties here when the same value exists. We conduct hypothesis testing to establish a basis so that they can collect data to determine whether to reject or accept the statement. Fig. 14 shows the results of the MMSE Test using the Wilcoxon Analysis.

Test Statistics[a]

	Post Test - Pre Test
Z	-4,109[b]
Asymp. Sig. (2-tailed)	,000

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

Fig. 14. The Results of the MMSE Test using the Wilcoxon Analysis.

Based on the findings of the statistical study test above, Asymp. sig. (2-tailed) p-value 0,000 is smaller than α 0.05 until the hypothesis is accepted. It can be concluded that Ha is accepted. This means there is a significant relationship between pre-playing and post- finishing playing the EmoGame application game. The EmoGame game application essentially involves brain exercise training consisting of memory puzzles and memory exploration that influence an effort to improve cognitive function among older adults with Mild Cognitive Impairment.

G. Expert Validation

The selection of the experts involved is based on purposive sampling. This type of sampling aims to require respondents with experience, expertise, skills and knowledge appropriate to the research topic. In this study, two experts were selected based on their expertise in elderly health and memory or emotional therapy. Table IV details the criteria of the participating experts.

TABLE IV. DETAILS AND CRITERIA FOR SELECTION OF EXPERTS

ID Expert	Expertise	criteria
E1	Older adults Health	Research in the field of MCI and Dementia.
E2	Memory or Emotion Therapy (*Reminiscence*) older adults	Research in the field of *Reminiscence* therapy

The assessments given by each expert are categorized to check their agreement in developing the game. Experts' opinions helped researchers evaluate applications developed and can be used for older adults with mild cognitive impairment. Among the aspects that have been emphasized are the aspects of the use of technology among older adults, the positive emotional effects, and the elements of memory therapy found in the EmoGame game application. Using simple technologies such as tablets and exposure to gaming technology to help seniors can evoke feelings of excitement and joy, creating positive emotions among them. One of the elderly health experts (Expert E1) agrees that games can stimulate positive emotions.

"It is essential because it can entertain and influence positive emotions to be happy. This game can entertain and train not to forget easily, and can improve memory because it is easy to use". (Expert E1).

In addition, the emotional or memory therapy approach (Reminiscence) is considered able to help the emotions and cognition of the elderly who have mild cognitive impairment. E2 experts give opinions on emotional or memory therapy (Reminiscence) that has been used in this research can help.

"The objects in the game are reminiscent of memories and past experiences such as those in emotional therapy or memories. Emotional or memory therapy can help lower the level of negative emotions in the elderly. I agree if games are developed for seniors with this therapeutic approach". (Expert E2).

In addition, E1 Expert also gave an opinion,

"The game is easy to play, and the objects in the game are reminiscent of memories and experiences." The games were developed to stimulate the emotions of the past and can provide positive emotions. This game also trains to improve memory and is easy to play". (Expert E1).

Based on the evaluation results and expert opinions, the game applications can help older adults with Mild Cognitive Impairment. Table V summarizes the results of the expert evaluation.

TABLE V. RESULTS OF EXPERT EVALUATION

EmoGame Gaming Application		Expert Assessment		
	Element		**Yes**	**No**
1) Digital Game Technology	Digital games Tablet platform	Games affect positive emotions and improve cognitive.	✓	
2) Memory exploration game.	Elements of memory therapy (Reminiscence)	Emotional or memory therapy (*Reminiscence*) is recommended for the training of older adults.	✓	
3) Puzzle Games	Cognitive elements	Games for older adults can help cognitive and positive emotions.	✓	

V. Conclusion

In general, research shows that play is an essential factor in training seniors with MCI. Although the research was conducted by developing game applications with a reminiscence memory therapy approach, the results showed that cognitive enhancement and affecting positive emotions are very significant where positive memories can cause positive emotions. In contrast, negative memories will contribute to emotional decline or failure (negative emotions).

Game applications that have been developed for seniors with MCI are expected to help seniors with positive emotions and improve their cognitive abilities. This game will be used to train the memory and emotions of older adults and solve their problems. The study results show that each factor of user involvement in the game can impact older adults. However, this factor's high or low impact is influenced by the duration of user engagement when playing EmoGame games application. The game development in this study bridges the gap in the literature review in-game engagement for seniors with every factor, feature, and correlation of game design capable of influencing and enhancing positive emotions among older adults. Researchers believe that the games that have been developed could be beneficial to older adults in the future.

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