Journal of Human Centered Technology Vol. 1: No. 2 (2022) 64 – 80
Journal of Human Centered Technology
E-ISSN: 2821-3467
https://humentech.utm.my

Verification of Game-Based Psychotherapy Intervention Model for Elderly with Memory Disorder Using Expert Review Approach

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Received 16 April 2022; Accepted 12 July 2022; Available online 06 August 2022
https://doi.org/10.11113/humentech.v1n2.23

Abstract:
Game interventions have been demonstrated to have significant effects in terms of increasing treatment adherence and accessibility in the health profession. The use of game has a great therapeutic influence on the experience when doing recovery workouts. Due to its strengths, a game-based intervention model for elderly with memory disorder is proposed. The proposed model consists of both exogenous and instantaneous factors as its main components. Nine exogenous factors are *attitude*, *emotion*, *skill*, *belief*, *support*, *attractive*, *fun*, *reminiscence*, *complexity*. Six instantaneous factors are *perceived focus, enjoyment, motivation, comfortability, perceived control,* and *boredom.* To ensure its correctness, verification procedure has been carried out by using an expert review approach involving five experts from three different domains. Qualitative and quantitative feedbacks from the experts are used in refining the proposed model. Our works can be extended by incorporating other related theories to strengthen the model such as reminiscence and flow theories. The improved model is significant in providing a guideline of game-based intervention to other related domains. Our works are believed as effective in improving cognition among elderly, the interesting and positive findings can be attributed to the integration of digital game and psychotherapy for elderly, particularly those with memory disorder symptoms.

Keywords: Elderly; Expert review; Game-based intervention; Memory disorder; Model verification

1. Introduction

The longevity of human has evolved to at least sixties or more and it is expected to reach 900 billion in coming 10 years. Statistic shows that about 62.3% of these elderly are located in the Asian countries [1] and majority of them are expected to be in their eighties or older. According to the findings of the Malaysia 2020 Census, the group of senior citizens aged 60 years and above is recorded as 3.4 million or 10.4 percent of the total population. This number is an increase compared to 2010 which recorded a population of 2.2 million or 8 percent and is expected to increase further in the future [2]. Cognitive impairment is one of the problems associated with the elderly with impairments, [3] in which

older people begin to suffer major changes such as severe memory loss, sluggish reaction and movement, and being more prone to accidents [4]. It is impossible to deny them assistance in cognitive, emotional, and physical areas, since they contribute to the growth of rehabilitation with the help of adaptable technology. These tailored solutions aid in assisting disabled elderly persons to enhance their quality of life [5]. Memory disorders such as Dementia and AD are the most prevalent cognitive impairment illnesses among the elderly which exhibit the declined in memory functions and associated with progression of losing memory [6].

There are two main treatments available for memory disorder namely pharmacological treatments and non-pharmacological treatment. In the treatments for memory disorder, pharmacological treatment has been used in most of the hospitals where doctors prescribe medication to help in delaying the degenerative tissue in the brain. [7]. However, medication seems not to function in the very early phases of the disorder and its effectiveness in the latter stage of impairment also seems to be limited [8]. In addition, severe overdose may lead to a loss of awareness and consciousness [9]. The usage of drugs is costly and there are potential side-effects toward patients. Due to these drawbacks, it makes non-pharmacological interventions a better choice [10–11]. Other than common therapies in holistic approach such as reminiscence therapy, validation therapy, reality orientation therapy and cognitive stimulation therapy [12, 13], games have emerged as digital instructive and entertaining equipment designed for a person's cognitive and skill development [14]. This sparked our interest in simplifying and specifying assistive game intervention, since the majority of Asian older adults had very limited experience with ICT-based systems [15]. Cognitive stimulation, similar to reality orientation, is usually provided in a social environment and involves cognitively oriented tasks and activities, such as word games and puzzles, that are performed by the participants [13, 16].

In this study, the intervention to delay the progressive of affected neurologic pathologies is introduced as game-based psychotherapy intervention model. This paper focuses on how the proposed game-based intervention model for elderly with memory disorder is verified by using an expert review approach. The improved version of the proposed model is presented as the outcome of the process.

1.1 Elderly-focused intervention model

Early studies indicate that a fully integrated continuous treatment is appropriate in a partnership with shared resources across health providers. Over the last several decades, the development of new technologies has resulted in the creation of new instruments that are simple to use, such as tablets, which have been widely available in society and have helped in a variety of fields, including neuro-psychological and cognitive rehabilitation [17]. At the most basic level, people who have received method psychological feature rehabilitation need assistance in repairing, limiting, or alleviating their psychological feature deficiencies [18]. Cognitive rehabilitation helps intervene: (1) in the sequence of stimulating and improving modified features with the help of objections to these characteristics, (2) in promoting use of other mechanisms or preserved skills (compensation) or (3) in the application of entirely different methods to minimize pathological problems [19]. As a result, elderly with mental illness are able to rehabilitate or maintain their cognitive abilities and maintain the highest possible level of autonomy through other psychological feature rehabilitation therapies and protocols that focus on memory, orientation, and communication skills as well as motor activities [5]. The elderly generation represents both a significant market opportunity and a challenge for the IT industry in determining on how new technologies can be effectively designed for this group [20]. Furthermore, as the elderly population grows, so will the number of people who require assistance with daily activities and those who require long-term care [21]. Intervention models in the field of health for elderly have been reviewed including intervention reminiscence-based screening (IRBS) model [22], self-care intervention model [23], elder abuse intervention model [24] as well as game theory model for menopause [25]. However, these models do not meet the scope of this research which focuses on elderly and are not suitable to be implemented in psychotherapy intervention for memory disorder.

The IRBS model emphasised on the need of triggering the brain to recall childhood experiences via three screenings: sensory functions for hearing and responding verbally, cognitive function, and recollection function, with a particular emphasis on childhood activities [22]. This model includes three themes of trigger recollection function that may help to avoid early dementia and sustain good ageing: mental activation, interactive communication connection and physical activity. In terms of mental activity, elderly should pay close attention to their surroundings via the senses, particularly when listening to music or watching television [26]. Meanwhile, the theme of interactive communication connection involving traditional games coded in encouraging and motivating the elderly to communicate and reminisce because elderly tend to withdraw from others due to difficulty to express feeling [27]. Despite the fact that physical activity may be useful as an intervention strategy among healthy older individuals in either a nursing home or in the community, it is not ideal for those who struggle with physical mobility inconvenience.

Goes *et al*. [23] proposed a self-care intervention model in compliance with self-care deficiencies identified by investigating self-care behaviour for older individuals living in both densely and sparsely populated rural locations,

according to the findings of their study. In the model, theory of self-care and theory of self-care deficit [28] are associated in both diagnosis and intervention phase in order to provide a "safety net" before a health crisis occurs to the elderly. The main component in the model is general profiles of functionality (GPFs) including the memory function, attention, emotional functions and cognitive functions assessed through questionnaire. Despite the component of GPFs, the internal factors within the elderly are not assessed during any phase in this model which the level of intrinsic factors might be the stimulant towards the intervention itself [29].

Another model proposed in health care for elderly is elder abuse intervention model [24] which aimed to study the multidimensional and complex relationships between risk factors. This model is guided by theories of elder mistreatment [30, 31], research on risk factors for elder mistreatment, and the ten years of experience of academics and employees at an Elder Abuse Forensics Center who have examined more than 1,000 cases of elder mistreatment. One of the components in this model is trust or believe [32] which resulted in emotional dependency due to impaired physical function and mental illness. Although the component of believe is important in an intervention, however the domain of this model does not resemblance the need of improving the memory function of an elderly who suffered from memory disorder.

At the meantime, Thouzeau and Raymond [25] proposed game theory model for menopause taking into account of a decline in maternal mortality, a rise in grandmothering, a reduction in the competition between older and younger women for reproductive resources, and a shift in the degree to which they are connected are all contributing factors. These variables measure the proportion of selfish behaviour and emotional fling as parameter that can affect the intervention for menopause. However, the condition favouring the maintenance of menopause are not equivalent to the condition favouring the emergence of memory deterioration.

A care model is a thorough and comprehensive plan for providing health care services based on evidence and established standards [33]. There were a variety of care rehabilitation models, which differed across organisations and nations. In scientific literature, although, there is little fragmented information on particular care models [34] where models are characterised by flexibility, given that recovery journeys are unique and thus need an individualized rehabilitation strategy. Meanwhile, in the context of game-based psychotherapy intervention, psychotherapy games are unquestionable flow activities and play is "the flow experience par excellence" [35]. A typical model of variables for psychosocial treatments shows that non-specific aspects are more important to results [36]. For instance, evidence-based psychosocial interventions can be broken down into their non-specific elements [37] to social skills training for schizophrenia, including conduct-based instruction and role modelling, rehearsals, correctional feedback, positive improvement and strategies to ensure adequate practical experience in the application of skills in an individual. Elements that are not restricted to a particular disease or collection of symptoms have also been found for psychodynamic models of psychosocial action. These include the impact and expression of emotions, exploring efforts to avoid distressing thoughts and sentiments, identifying recurring themes, discussing past experience (developmental approach), focusing on interpersonal relations, focusing on the therapeutic relationship and exploring fantasy lives [38].

Hence, in this study, a psychotherapy intervention model incorporating digital games for memory disorder among elderly was designed and developed in order to help both psychologist and ICT expert to understand and stimulate the integration between technology and psychology in the field.

1.2 Games and intervention

Game interventions were found possess sensible benefits in boosting the treatment adherence and accessibility within health fields [39]. The flexibleness of personal deployment, the wider range of benefits, and the value of relief suggest that game-based intervention is among the most effective decision to deliver non-pharmacological treatment to individual with memory disorder. Therefore, additional sturdy proof is required to accurately and fully ascertain the impact of these intervention for it to serve the purposes [11]. Given the significant of the hyperlink between mechanics of learning and game mechanics [40], specific research is required in the development phase of intervention game where the games have to be user friendly with simple interface design, not complex and easy to be used and interacted by all the users. It is recommended to utilise tab gesture as interaction medium and provide feedback to response on correct or wrong answer [17].

The use of game has a great therapeutic influence on the experience when doing recovery workouts. Games at their foundation need a lot of care to be placed into the simplest mechanics in crafting meaningful play. This will create a fun atmosphere alongside sufficient reviews and lots of instant benefits. Brain exercises are fundamentally tedious and mechanical because of their design, thus why it can be so beneficial to use a playful coat [41]. However, owing to the difficulties of mapping rigorous rehabilitative activities to fun game dynamics, this enticing coat may not be sufficient as

a motivating motor for the patient. Motivation in games, on the other hand, may be generated via a variety of methods that can work together to accomplish a common goal.

For instance, a memory game in remembering the position of the blocks introduced by Zhunio *et al*. [42] recently to guess the which block shows the same item. This game required the player to guess the similar box and remember their position to match with the other similar box. Another game application with integration of four different games, Cubbie, Colorie, UnlockIt and Concentration game has been introduced in a mobile application [43], however these games are tailor-made for concentration training where there is no element for improving memory disorder been found. Besides, there is no rewards provided in the games. It is hard to engage player in the games when there is no goal-oriented task to extrinsically stimulate player's motivations [20]. Kristensen and P. Burelli [44] have introduced a tactical-based game name Lily's Garden where the user has to complete the task within numbers of move given. However, this feature will demotivate the user as it is suggested to not include losing element in the game for elderly [45]. Recent game introduced by Lau and Agius [46] named *A-go!* is proposed for improving the cognitive function of elderly. This application is based on instrumental activities in daily life (ADLs) game construct to mimic real-life activities. It is intended to enable first-person viewpoint immersive engagement by allowing interaction with a Leap Motion controller through the V2 SDK and gesture detection. This concept also has been integrated by Rodriguez-Fortiz [47] in their 3-Dimensional games.

2. Methodology

Overall methodology of our works consists of three main phases, which are model design and development, model evaluation, and model refinement as illustrated in Figure 1. Two main activities in evaluating the model are verification and validation by using different approaches. This article focuses on verification process which utilizing expert review approach.

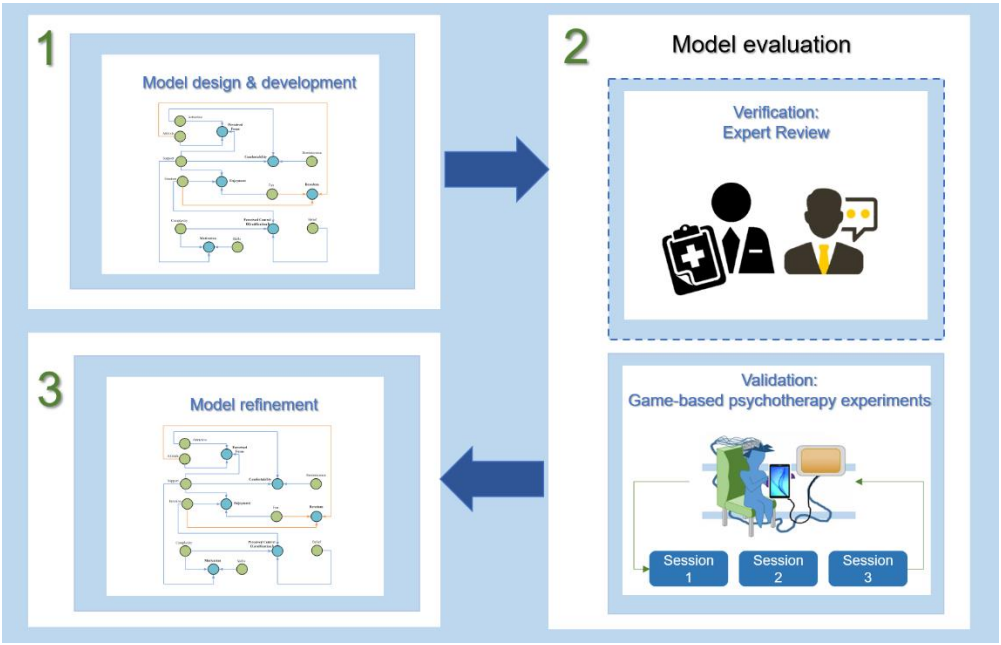

Figure 1. Overall methodology

2.1 Design and development of game-based intervention model for memory disorder

Game-based Intervention Model for Memory Disorder consists of both exogenous and instantaneous factors as its main components. There are nine exogenous factors identified through extensive literature review: Patients: *Attitude*, *Emotion*, *Skill*, *Belief*; Caregiver: *Support*, Games: *Attractive*, *Fun*, *Reminiscence*, *Complexity* as illustrated in Table 1. These factors represent a combination of three different dimensions which are patients' characteristics, environmental support by caregiver, and game criteria.

Table 1. Exogenous factors

Exogenous factors	Nomenclatures	Proponent
Patients – Attitude	*Att*	[48, 32]
Patients – Emotion	*Emo*	[48, 49]
Patients – Skill	*Skl*	[32, 50]
Patients – Belief	*Blf*	[51, 52]
Caregiver – Support	*Spp*	[50, 53, 54]
Games - Attractive	*GAtt*	[55]
Games – Fun	*GFn*	[19, 56–58]
Games – Complexity	*GCx*	[58–61]
Games – Reminiscence	*GRem*	[32, 58, 61]

2.2 Patient's characteristic contributing factors

The efficacy of the intervention relies on the particular personality traits of the targeted group [53]. Committing to the intervention rely on the patient's attitude in understanding and accepting of what their problems and symptoms indicated and the prescription as well as diagnostics applied [32]. Seeking aid must have been anything to do with "having collapsed", and deemed sufficiently caused by a disaster, "if it is possible" [48]. Consequently, the positive *attitude* towards accepting the treatment in an intervention influence the successfulness of an intervention.

Emotion may also lead to positive or negative feelings, and can influence the patient's experience of the treatment. Negative outcomes in cognitive therapy experiments may often be linked, at least in part, to the way exercises are carried out and, in particular, to inadequate attention to patient desires and responses [49]. Intervention targets are likely to be followed with knowledge to promote an awareness of cognitive abilities and challenges and by a positive consideration of specific emotional responses or other requirements and, where necessary, connections with other possible sources of help [49]. Thus, *emotion* of a patient is identified as one of the exogenous factors in the proposed model.

The scope for the intervention to be delivered efficiently to meet the variety of capabilities integrated with the degree of engagement was another prerequisite for successful adoption [50]. This means the patients' abilities are necessary to ensure they are prepared to carry out the activities throughout the treatment. If contemplating designing an intervention program utilizing ICT for older adults, the key obstacles include learning success, curriculum access, encouragement to utilize the Internet and faith in technology. It is crucial that patients feel confident using technology during the therapy sessions to improve patient involvement [32]. Nonetheless, the *skill* of the individual is the criteria for therapy in order to comply with the procedures or therapies.

It is also suggested that belief of the patient towards the intervention is significant to ensure them engaged in the psychotherapy sessions and is a component that is necessary to outweigh concerns about the treatment [51]. As reported by Nymberg *et al*. [52], some patients have disappointment and mistrust in health-care IT programs that they identified as bad. Taking into account the fast growth and dissemination of IT technologies in other fields, participants were confused and dissatisfied with the reluctance of policymakers in this matter and shared a deep desire for user-friendly and open digital resources, as well as studying help and knowledge about them. Thus, *belief* of the patient towards the intervention is significant to ensure the efficacy of the psychotherapy sessions.

2.3 Caregiver contributing factor

Caregiver performed a vital part in implementing, guiding, and managing operations to create a sense of protection and guidance for people with dementia [50]. They are present in order to facilitate selection of the degree of difficulty suitable for a specific patient [53]. Patients have acknowledged that staff members had made a significant commitment to their welfare [54] with *support* when completing activities were considered important to successful intervention as by establishing the right level and relevance of interventions for people with cognitive impairment [48]. Therefore, *support* from caregiver is identified as exogenous factor in this study.

2.4 Game elements contributing factors

In order to attract elderly who are not familiar with technology to play with the game, the design of interface must be tempting towards the target choosing what kind of light to be used, object's intensity, how the object should be

positioned, avoiding dazzling to get user attention directed to the important object or area in the game and does not disturb the vision at the same time [55]. Games should be fun and enjoyable. Older gamers play games to relax and have fun and value choice, enjoyment and meaningful play [62]. For the option of gameplay in rehabilitation games for patients with memory disorder, difficulty or challenge options should be increased gradually and not at a high rate. This is to avoid deterring the users from using the game, which will eventually help them to enhance their skills and condition [59–62]. In the context of task performance, when one's skill is too low and a task too hard, people become anxious. Alternatively, if the task is too easy and the skill is too high, people become bored [62]. Treatment requires a graded plan of different levels that is closely controlled within the capability of the participant, with incremental changes, regularization of sleep and the collaborative development of plans working towards rehabilitation [32]. It is suggested that the game to be something familiar or based on the previous experience for memory recall with *reminiscence* effect. Thus, *attractive*, *fun*, *complexity* and *reminiscence* in a game are considered as exogenous factors in the model.

A typical model of variables for psychosocial treatments shows that non-specific elements are more important to results [36]. Elements that are not restricted to a particular disease or collection of symptoms have also been found for psychodynamic models of psychosocial action. These include the impact and expression of emotions, exploring efforts to avoid distressing thoughts and sentiments, identifying recurring themes, discussing past experience (developmental approach), focusing on interpersonal relations, focusing on the therapeutic relationship and exploring fantasy lives [38]. According [63], non-specific elements by linking affect to interpersonal relationships (encouragement (motivation), clarification of feelings (enjoyment and boredom), mood rating (comfortability), ability to focus (perceived focus)) and interpersonal skills building (ability to decide (perceived control)) as measure and desired outcome (instantaneous factors) of the psychotherapy intervention model [63].

There are six instantaneous factors identified which are *perceived focus*, *enjoyment*, *motivation*, *comfortability*, *perceived control*, and *boredom* as depicted in Table 2. *Attitude* of patients, *attractive* of games or tools, and *support* of caregivers demonstrate variation in improving *perceived focus* towards the psychotherapy. Meanwhile, *emotion*, *fun* of game and *support* from caregiver contribute to *enjoyment.* On the other hand, *complexity* of game, *skills* of patient and *support* contribute to the factor of *motivation.* At the meantime, *comfortability* is contributed by *support* from caregiver, *attractive* and *reminiscence* of game. Besides, *belief, emotions of patients* and task challenge (*complexity)* are contributing factors that keep an individual to be engaged with a task as being affected by the perceived control. Last but not least It is identified that *attitude*, *fun* and *emotion* are contributing negatively to *boredom.*

Table 2. Instantaneous factors and related contributing exogenous factors

Instantaneous Factors	**Contributing Factors**	**Proponent**
Perceived Focus	Patients – Attitude	[64]
	Games – Attractive	[65]
	Caregiver – Support	[66]
Enjoyment	Patients – Emotion	[67]
	Caregiver – Support	[68]
	Games – Fun	[69]
Motivation	Patients – Skill	[60, 69]
	Caregiver – Support	[70]
	Games – Complexity	[71]
Comfortability	Games – Attractive	[72]
	Caregiver – Support	[73]
	Games – Reminiscence	[74]
Perceived Control	Patients – Belief	[75]
	Patients – Emotion	[76]
	Games – Complexity	[76, 77]
Boredom	Patients – Emotion	[79]
	Patients – Attitude	[80]
	Games – Fun	[81]

Based on the relationship between exogenous factors and instantaneous factors, the proposed game-based psychotherapy intervention model is designed and is constructed by using Network Oriented Modelling approach. Figure 2 illustrated the proposed conceptual model with its detailed interconnected nodes.

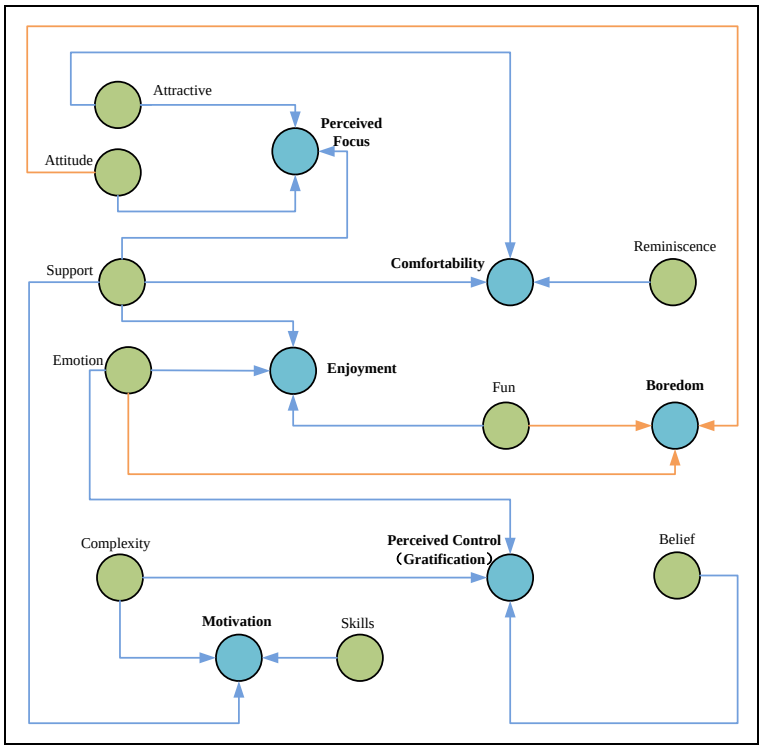

Figure 2. The proposed game-based intervention model for elderly with memory disorder

The green nodes in Figure 2 represents the exogenous factors while all blue nodes are the instantaneous factors. The interaction between these nodes exhibiting either positive and negative characteristics; relating to the exogenous factors in terms of its effect towards instantaneous factors. Blue connections exhibit the positive relationship while the orange connections reflect the relationship in negative way. In evaluating the model, both verification and validation have been conducted. Detail procedure of verification process is covered in next sections.

2.5 Model evaluation

To evaluate the proposed model, both verification and validation are conducted in ensuring the correctness [82] and workability of the model. This paper focuses on model verification involving a thorough review of the proposed model by the selected experts from three different fields. For this purpose, five experts have been chosen as recommended by Nielsen [83]. The chosen experts are those with at least ten years' experiences in their particular field related to this study. There are two experts from computing and software development, two experts from psychologist academia whom have direct interaction with elderly and one academician expert in game were involved. They came from a diversified yet similar understanding in the game development and psychotherapy environment. This similarity was crucial to ensure that the experts were able to establish review and provide quality constructive feedback on the proposed model. They have been selected and personal interviews are conducted individually [83]. Table 3 depicts demographics of the experts involved.

Table 3. Demographics of experts

Experts	Field of Expertise	Experience (Year)
1	Psychologist	20
2	Psychologist	10
3	Computing and Software Development	10
4	Computing and Software Development	20
5	Game and Gamification	10

To start the procedure, the research background including issue and problems of the research, research objectives and the scope of research were explained to the experts, as well as the objective of the activity. The proposed game-based psychotherapy intervention model is then presented to the experts with thorough explanation. For the purpose of verification, both qualitative and quantitative feedback were gathered through interview and survey respectively. For quantitative part, there are eight model quality dimensions have been included in measuring the correctness of the model which are Clarity, Visibility, Understandability, Comprehensive, Accuracy, Effectiveness, Evolutionary and Flexibility [84] which enable the measurement of correctness for the model as illustrated in Figure 3.

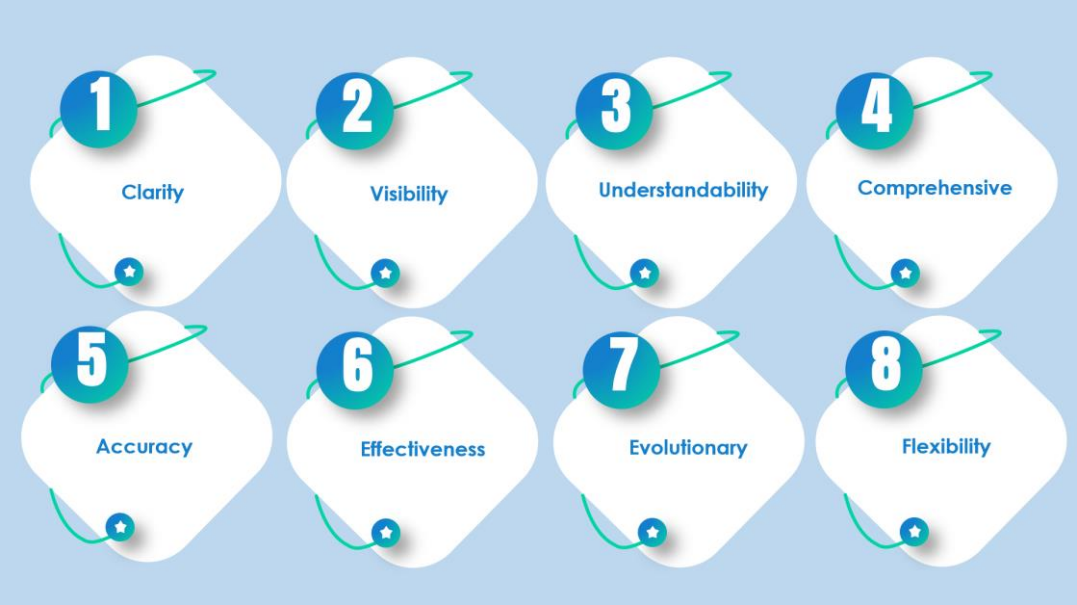

Figure 3. Eight Dimensions of model quality used in expert review

The eight dimensions of quality model questionnaire is adapted from Khanna *et al*. [85] to suit the context in this study. Each dimension consists of three items with five Likert Scale of 1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree, and 5: Strongly Agree. The verification of the model is based on the results from questionnaire as well as the feedbacks from experts. The feedback acquired from experts were categorized into the eight quality model dimensions and analysed. The model is verified by experts selected from various practitioners and corporate users with good subject domain knowledge.

3. Results and Discussion

This section explains qualitative and quantitative feedbacks and recommendations from the experts after reviewing the proposed model. Most of the reviews are emphasizing on the structural and presentation of the model. Quantitative reviews are from three items for each dimension of quality model.

3.1 Clarity

The dimension of Clarity defines the clearness of the constructed proposed model. Table 4 shows the results of all three items in dimension of *Clarity*.

Table 4. Results for dimension of Clarity

No	Items	Mean Value
C1	The Psychotherapy Intervention Model is clearly presented.	3.6
C2	The nodes in the Psychotherapy Intervention model are clearly defined.	4.0
C3	All relations of the nodes are clearly presented.	4.2

Item C1 scores 3.6, Cl2 scores 4 while Cl3 scores 4.2 in the mean value of the five Likert scale. Expert Five commented on the clarity of the model during the interview with experts as followed:

> *"Need to improve the clarity of reading in terms of color usage, simplified connection, categorised the nodes based on three types of IV."*
>
> *[Expert Five]*

As the layer of presentation is where the model is presented to real users, this is where there will be some conceptual mistakes, or at least the point where users will voice feedback that can contribute to model change. It is suggested to improve the clarity of reading, colour usage, simplified connection and categorised the nodes based on three types of exogenous factors which are 1) game elements, 2) patient's factor and 3) environmental factor. Thus, the model is revised by categorising the exogenous factors into three categories as mentioned by Expert Five.

3.2 Visibility

As for the dimension of Visibility, the first item (V1) scores 3.8, second item (V2) scores 3.6, while the third item (V3) scores 4.4 out of 5 in mean value as shown in Table 5.

Table 5. Results for dimension of Visibility

No	Items	Mean Value
V1	The Psychotherapy Intervention model is visible to be followed.	3.8
V2	The relations involved can be followed easily.	3.6
V3	The Psychotherapy Intervention model can be a guide to solve related tasks.	4.4

This means the proposed model is visible to the audience. Expert Four commented on the visibility of the model in the interview conducted as followed:

> *"Maybe make the graph presentation (of nodes relationship) to be more natural."*
>
> *[Expert Four]*

Expert Four addressed the issue in visibility by suggesting graph-design presentation. However, it is essential to demonstrate the causal relationships between exogenous and instantaneous factors in the model using connections that could not be shown in the graph. Thus, suggestion from Expert Four is not taken into account, nonetheless, in order for better visibility, the model is reconstructed to distinguish nodes between exogenous and instantaneous factors.

3.3 Understandability

On the other hand, the dimension of Understandability defines that the audiences are able to understand the flow of the model. Table 6 shows the results for all three items in the dimension of understandability.

Table 6. Results for dimension of Understandability

No	Items	Mean Value
U1	The Psychotherapy Intervention model is easy to understand.	4.2
U2	The label of each elements is understandable.	4.4
U3	Adhering to the Psychotherapy Intervention model is easy.	3.8

Item U1 scores 4.2, U2 scores 4.4 out of 5, while U3 scores 3.8 in the mean value. Several experts pointed out that the model components were not in a sequence during the interview, which might lead to confusion as to how the model would be implemented. The feedbacks from Expert Two and Expert Four are elaborated as followed:

> *"The nodes look scattered and I am confusing which nodes are exogenous factors or instantaneous factors."*
>
> *[Expert Two]*

"The connection is messy and hard to understand. All connections look the same"

[Expert Four]

According to experts' feedbacks, it can be seen that the structure of the mode needs to be improved. To make the model simpler in terms of flow and the relation between components and levels, contrast presentation between exogenous and instantaneous factors are used as well as rearranging the coordinate of each component in the model for a better understanding sight.

3.4 Comprehensive

The dimension of Comprehensive indicates that the proposed model is integrated with all-inclusive factors. Item C1 scores 4.4, C2 scores 4.2 while C3 scores 4.6 in the mean value of the five Likert scale as shown in Table 7.

Table 7. Results for dimension of Comprehensive

No	Items	Mean Value
U1	The Psychotherapy Intervention model is easy to understand.	4.2
U2	The label of each elements is understandable.	4.4
U3	Adhering to the Psychotherapy Intervention model is easy.	3.8

From the interview, Expert One suggested to include the psychological elements in terms of the mental state of subjects, personality, the unexpected situation during experiments. The comment from Expert One is as followed:

"Include the psychological elements such as the mental state of subjects, personality, the unexpected situation during experiments."

[Expert One]

However, this feedback is beyond the study scope as this study focuses on memory disorder which the element of mental state will be constant and insignificant in this study. Meanwhile, since digital game is the core of the experiment, thus the personality is excluded and the unexpected situation during experiment is controlled. Nonetheless, the suggestions could be implemented in future study to further expand the target.

3.5 Accuracy

Dimension of Accuracy is to determine the extent to which data are correct, reliable and certified. The results of all three items for accuracy are shown in Table 8.

Table 8. Results for dimension of Accuracy

No	Items	Mean Value
A1	The Psychotherapy Intervention model is presented correctly.	4.4
A2	All properties are labelled correctly.	4.2
A3	All properties are connected correctly.	4.4

The first item (A1) scores 4.4, second item (A2) scores 4.2, while the third item (A3) scores 4.4 out of 5. This indicates that the proposed model is accurate in terms of the connectivity of the factors.

3.6 Effectiveness

On the other hand, the dimension of Effectiveness defines that the proposed model is able to be implemented in real situation. Item E1 to E3 score 4.6 in the mean value as shown in Table 9.

There are concerns that have been brought up by Expert Three regarding effectiveness of the model:

"1) For effectiveness, what are the nodes that are related to games? 2) How are they related to the development of engaging games? and 3) To develop games, do developers need to consider all nodes or just the ones in blue?"

[Expert Three]

As illustrated in the proposed model, there are elements exhibited by the game which are 1) attractive, 2) fun, 3) complexity and 4) reminiscence. These factors are connected to the correspond factor indicate the positive effect of the game elements toward the factors. This answered the first item.

Table 9. Results for dimension of Effectiveness

No	Items	Mean Value
E1	The Psychotherapy Intervention model guides in developing engaging games.	4.6
E2	Adhering to the Psychotherapy Intervention model will improve games engagement.	4.6
E3	Adhering to the Psychotherapy Intervention model will improve learning in games.	4.6

Expert three is an expert in Computing and Software Development and the concern is deviated towards the development of the game. Thus, for the second and third items, it is suggested a list of game criteria in the systemic literature review done by Sie-yi and Chepa [62] for developing an engaging game instead of referring the model itself. Therefore, to answer the third item, it is best to develop engaging psychotherapy game for elderly based on the list of criteria. Since the mean scores of each item is more than 2.50, thus the model is accepted in terms of its usability purposes and logical flows.

3.7 Evolutionary

The overall mean scores for all items in the dimension of Evolutionary (EV1, EV2, EV3) peak at 4.8 respectively which indicates the model is dynamic and provides opportunity for improvements. Table 10 shows the items and results for evolutionary.

Table 10. Results for dimension of Evolutionary

No	Items	Mean Value
EV1	The Psychotherapy Intervention model is dynamic.	4.8
EV2	The Psychotherapy Intervention model allows additional element(s) in the future.	4.8
EV3	The Psychotherapy Intervention model provides opportunity for improvements.	4.8

As commented by Expert One, it is possible to include the psychological elements such as the mental state of subjects and personality. Besides, feedbacks from Expert Three also bring to our attention to include all the criteria of the game in the future. Therefore, it is proven that this model allows additional element(s) in the future.

3.8 Flexibility

The overall mean scores for all items in the dimension of Flexibility (F1, F2, F3) peak at 4.8 respectively which indicates the model is adjustable and able to adapt with different factors in order to expand its functionality either in the same domain or different domain. Table 11 shows the items and results for flexibility.

Table 11. Results for dimension of Flexibility

No	Items	Mean Value
F1	The Psychotherapy Intervention model is flexible to be edited.	4.8
F2	The Psychotherapy Intervention model is adaptive to changes.	4.8
F3	The Psychotherapy Intervention model is generalizable enough to be applied for other related tasks.	4.8

Overall, most of the experts agreed that the model is a good attempt to solve the issues presented. After gathering and analysing the qualitative feedback provided through the expert reviews, the proposed model was refined as listed out in Table 12. In refining the proposed model, suggestions and recommendation from expert review are taken into account. The proposed model is amended in accordance with the feedback and recommendations. It can be inferred from the comments that most of the experts issued a design presentation amendment. The refined model is illustrated in Figure 4.

Table 12. Modification list on the Proposed Model

No	Before Refinement	After Refinement
1	All model components were not in group and scattered.	Exogenous factors were group into three main categories and model components were rearrange to sequence.
2	Nodes for exogenous and instantaneous factor were similar.	Nodes for exogenous and instantaneous factors are distinguish with different shades.
3	Relationship connections between exogenous factors and instantaneous factors were overlapping.	Rearranging the relationship connection between exogenous factors and instantaneous factors.
4	Relationship connections were the same for both positive and negative relationships.	Distinguish the relationship connections for both positive and negative relationships with solid line and dotted line.

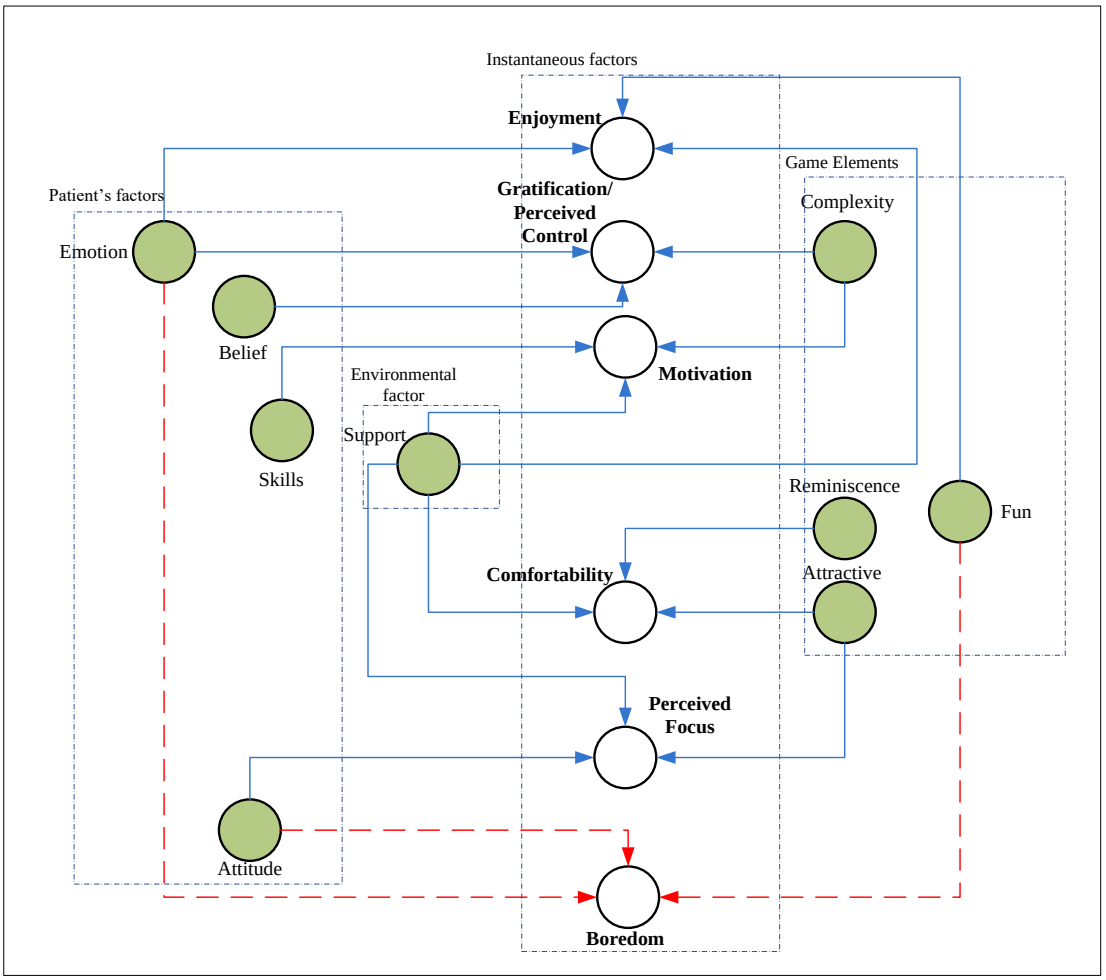

Figure 4. The refined model after verification

After amendment, a structural aspect of the refined model remained with the involvement of nine exogenous factors (emotion, skills, attitude, belief, complexity, fun, reminiscence, attractive and support) and six instantaneous factors (enjoyment, gratification/perceived control, motivation, comfortability, perceived focus and boredom). Improvements made are in terms of presentation aspect. The grey nodes indicate the exogenous factors which to contribute to the instantaneous factors (white nodes). The solid-lined arrow indicates positive relationship where the dotted line arrow depicts the negative relationship between the exogenous and instantaneous factors.

4. Conclusion

In a nutshell, the correctness of proposed model is measured via experts' review which based on of eight main dimensions of quality model; clarity, visibility, understandability, comprehensive, accuracy, effectiveness, evolutionary and flexibility. The proposed model is verified and amended accordingly. The findings show that majority of the experts (approximately 100%) in both domain experts and ICT experts have given positive feedbacks and useful recommendations in improving the proposed model. Potential future works can be the incorporation of other related theories to strengthen the model such as reminiscence and flow theories. The improved model is significant in providing a guideline of game-based intervention to other related domains. Our works are believed as effective in improving cognition among elderly, the interesting and positive findings can be attributed to the integration of digital game and psychotherapy for elderly, particularly those with memory disorder symptoms.

Acknowledgment

This research is funded by Ministry of Higher Education (MOHE) through Fundamental Research Grant Scheme (FRGS/1/2019/ICT02/UUM/02/4). Authors fully acknowledged MOHE for the approved fund which makes this important research viable and effective.

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