

Game based implementation of Cognitive Behavioral Therapy for introspective treatment of Social Anxiety Disorder

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Received: 2 October 2022; Accepted: 26 May 2023; Published: 31 May 2023

Abstract

Social anxiety disorder (SAD) is one of the most common mental health disorders in society worldwide. The prevalence rate is increasing within the population and this can affect an individual's quality of life and economic productivity. Cognitive Behavioral Therapy is an effective psychotherapy in treating SAD. Technological interventions through serious games in the treatment of SAD are seen as one of the alternatives in solving issues related to the conventional therapy. The Social Phobia Game was developed as the primary research instrument, for the acquisition of knowledge, awareness, and for self-treatment of SAD. It is a structure-based introspective computer game prototype developed based on the proposed framework presented in this paper, which is tested in an extensive evaluation phase. The evaluation phase is conducted through an effectiveness evaluation and usability evaluation. The results of the effectiveness evaluation showed a score difference of 15% in the pre-test and post-test user responses. Meanwhile, the results of the usability evaluation gave a high mean score of over 4.00. Thus, from the results of the effectiveness and usability evaluation, the framework implemented in the serious game prototype was seen to be able to help identify, manage, and raise awareness about SAD.

Keywords: Cognitive behavioral therapy, serious game, social anxiety disorder

Introduction

Social phobia or known as Social Anxiety Disorder (SAD) is an intense fear or anxiety shown by an individual towards one or more social situations, lasting up to six months or more (American Psychiatric Association (APA), 2013). Phobia patients have a perception that they will be judged negatively by others, thus causing them to react to social situations. The threats perceived by phobia patients are often inaccurate with actual ones because they process social situations as things that capable of giving a negative impact on them (APA, 2013).

SAD is one of the most common mental health disorders in the general population (Ambusaidi et al., 2022; Wong et al., 2016). Based on clinical studies, 36% is the current prevalence of SAD among a sample of young people aged 16 to 29 years (Jefferies & Ungar, 2020). Stigma or self-imagined stigma falls among the hindrance for patients to seek conventional treatment (Bharadwaj et al., 2017; Gierk et al., 2018). Social phobias can affect quality of life, causing difficulty in adjusting in society, as well as having economic implications (Baharum et al., 2018; Heimberg, 2002; Patel et al., 2002).

Cognitive Behavioral Therapy (CBT) is an effective therapy in treating social phobia with low relapse rates and recurrence of symptoms (Hofmann et al., 2012; Melfsen et al., 2011; Powers et al., 2008). However, face-to-face CBT treatment methods are expensive, time consuming, and require a high degree of cooperation between therapists and patients (Yusof et al., 2014). There are also patients who refuse to seek treatment through conventional therapy that requires patients to attend face-to-face sessions because these patients have inherent difficulty in interacting and sharing with strangers (Sun et al., 2021).

Technological interventions in the treatment of SAD are seen as one of the alternatives in resolving issues in conventional therapy, as well as being able to assist and improve patient functioning (International Organization for Standardization (ISO), 2011; Layton et al., 2020). One of the technological interventions is through serious games. The use of serious games can provide social awareness to patients and society by focusing on issues related to social phobia that are usually forgotten or not generally known, with purposes to encourage recognition, educate, and raise awareness of SAD (Lim & Logenthiran, 2016; Pereira et al., 2014).

Serious games can be used for the development of skills such as orientation skills, situation analysis skills, strategic planning, psychokinetic skills, and skills of learning new things (Drosos et al., 2019). This study discusses a serious game-based CBT for SAD that is developed based on the framework model described in this study.

Literature review

Serious games emphasize learning elements that have structured game content for knowledge and skills sharing. Structured game content allows players to achieve objectives and goals based on the context offered in the game (Cruz-Lara et al., 2013). Serious games have been used in various fields and are also used as an assistive tool to treat SAD (Panagiotakopoulos et al., 2020; Philbin-Briscoe et al., 2017).

The use of serious games can facilitate information sharing, save costs, and improve quality of life, health, education, and social participation (Albala et al., 2021; Borg et al., 2021; Carrión et al., 2019). An appropriate and frequently used method of therapy in treating SAD is CBT, which is also a well-established and empirically validated treatment method (Fenn & Byrne, 2013; Lipsitz & Schneier, 2000; Öst & Clark, 2013; Williams & Garland, 2002).

The aim of cognitive behavioral therapy is to teach rational ways of thinking and behavior in social situations or activities that can trigger anxiety (Heimberg, 2002). Based on the issue of conventional treatment methods, serious games based-CBT can be used as an alternative to treat social phobia.

There are existing game systems developed to help treat social phobias. "Flair" is dialogue-system game that is developed to provide awareness and understanding to the society from the point of view of phobia patients, which is usually about their fears, emotions, and behavior in social situations. The game integrates CBT, which serves as a supportive psycho-educational material during conventional therapy sessions for SAD patients, to visualize and familiarize them with face-to-face treatment sessions (Romera Sanchez & Kunze, 2018).

Báldy et al. (2021) developed a game to raise awareness of CBT for SAD targeting university students. The game contains three CBT techniques, namely cognitive restructuring, awareness training, and exposure training that simulate the autonomous physical symptoms of social phobia.

The use of CBT is not limited to SAD only, but is also used in treating other types of phobias. “ZeroPhobia” is a Virtual Reality Exposure Therapy (VRET) gamification system for acrophobia developed based on the CBT module, showing a significant decrease in anxiety scores in repetitive game levels compared to levels played for the first time. Modules used in the game include psycho-education, goals and treatment principles, exposure therapy, automatic thoughts identification, assisted cognitive development, and relapse prevention (Donker Van Esveld et al., 2018; Donker Van Klaveren et al., 2020).

Hence, SAD games based on the implementation of CBT can be used for knowledge acquisition, awareness, and for self-treatment. In the next section, this study will discuss serious game design based on the implementation of CBT that acts as an assistive tool to treat SAD.

Methodology

A serious game framework based on CBT was developed to guide the development of games aimed at providing education, awareness, and treatment of social phobia. A literature review was conducted to identify the components of the framework and get ideas about the game to be developed. The information obtained is used to identify elements of serious games and CBT to be applied within the framework.

There are three main structural components of the framework which are the game element, social phobia scenario element, and therapeutic element. The main structural components of the framework consist of elements that have been arranged and grouped according to relevant themes. Once the elements were grouped, mapping was carried out to form a serious game framework based on CBT for social phobia as shown in Figure 1.

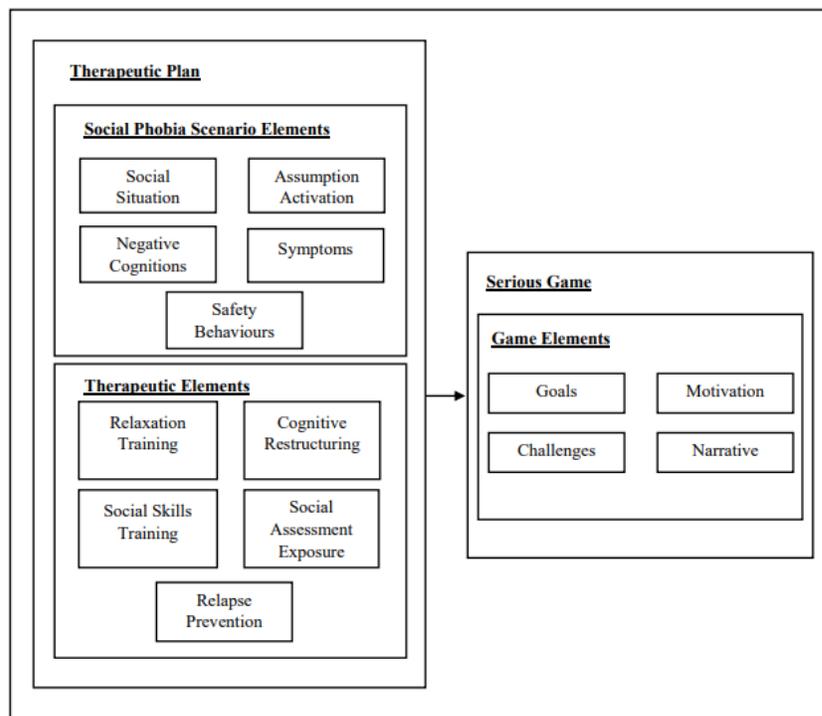


Figure 1. Game-Based CBT for SAD Framework

Social phobia scenario elements

Social phobia scenarios are retention factors to describe the continuity and life cycle of individuals with social phobias and the difficulties they face in engaging in social situations. This process will be repeated if the phobia patient is exposed to a social situation without proper treatment or assistance. Social phobia includes social situations, activation of assumptions, negative cognitions, symptoms, and safety behaviors (Clark & Wells, 1995; Moscovitch, 2009; Öst & Clark, 2013; Rapee & Heimberg, 1997). These elements describe the process that occurs to individuals who have negative thoughts and perceptions of the feared social situation. Table 1 describes the elements in the social phobia scenario.

Table 1. Social phobia scenario elements

Elements	Explanation
Social situation	The life of a social phobia patient in the invoking anxiety situation or activities. E.g. workplace and public places.
Assumptions activation	Refers to the activation of negative assumptions when in a social situation.
Negative cognitions	The tendency to think negatively when in social situations that are considered dangerous and unsafe.
Symptoms	The onset of behavioral, cognitive and somatic symptoms when in a social situation is perceived as a burden and discomfort to the patient.
Safety behaviors	Actions to save oneself from negative public evaluations when in a stimulus or anxiety triggers situation.

Source: Clark and Wells, 1995, Moscovitch, 2009, Öst and Clark, 2013 and Rapee and Heimberg, 1997

Therapeutic elements

The therapeutic elements consist of relaxation training, cognitive restructuring, social skills training, social assessment exposure, and relapse prevention (Overholser, 2002). Systematic and well-paced therapeutic element is a mechanism of CBT to treat SAD. These CBT mechanisms include training and treatment that can help SAD patients manage themselves in social situations. Table 2 shows the therapeutic elements and descriptions for each element.

Table 2. Therapeutic elements

Elements	Explanation
Relaxation training	A technique used to reduce and control anxiety using breathing techniques.
Cognitive restructuring	The process of identifying and focusing on negative thoughts that patients want to change.
Social skills training	To help correct negative thoughts and beliefs when in social situations. Forms a new perspective on the social situation.
Social assessment exposure	Exposure to social situations to reduce anxiety and negative reactions. Helps generate rational thoughts and responses.
Relapse prevention	Encourage the ability to challenge oneself to deal with social situations through continuous self-management in handling social situations.

Source: Overholser, 2002

Serious game elements

Game elements include goals, challenges, motivation, and narrative (Alexiou & Schippers, 2018; De Lope et al., 2017; Dondlinger, 2007; Shi & Shih, 2015). These elements are used to ensure that the games developed are interesting and able to deliver the desired learning outcomes. A description of the game elements used is shown in Table 3.

Table 3. Game elements

Elements	Explanation
Goals	Refers to the purpose and objectives of the game. Describe the learning outcomes that need to be achieved and understood.
Challenges	Analyze and identify safety behaviors based on social situations.
Motivation	Rewards are given to give encouragement to the players.
Narrative	Describes the content and storytelling in text form.

Source: Alexiou and Schippers, 2018, De Lope et al., 2017, Dondlinger, 2007 and Shi and Shih, 2015

Next, model validation is conducted to obtain expert validity on the accuracy of the model concept, the appropriateness of structural element selection, and the correlation between elements in the model. Expert validation instruments were used for the evaluation of the framework through interview sessions. The instruments developed consisted of 12 items and each validation session took from 90 to 120 minutes. The validation results show expert’s agreement of the developed model on the accuracy of the model concept, the appropriateness of the element selection, and the correlation between the elements in the model. Therefore, the framework can be used and served as a guideline in developing serious games for providing CBT to treat SAD patients.

Implementation of the instructional design model

The design of this study is divided into four phases, namely the requirements analysis phase, the framework design phase, the prototype development phase, and the evaluation phase. Figure 2 shows activities conducted for each phase.

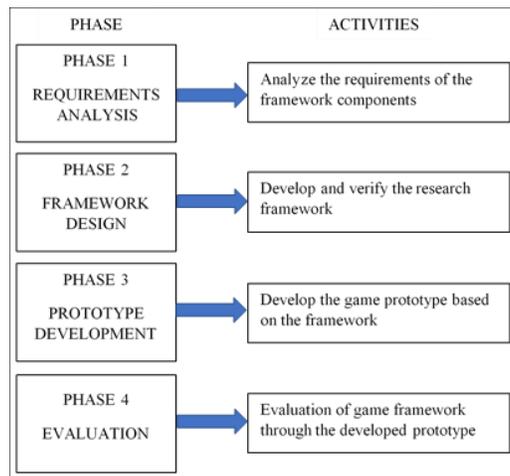


Figure 2. Instructional design model

Requirements analysis is conducted to identify serious game components and therapy components for the formation of a serious game model for social phobia. Next, a framework design is developed based on components of serious games and therapy. Expert validation is conducted to verify the framework components. Prototype development involves the implementation of a framework in the game prototype.

Table 4. List of items in the game design document

Items	Explanation
Genre	Visual novels - based text and static visuals.
Storytelling	Describes the situation of a SAD patient in a social situation and a treatment plan that can help the patient when in a distressing situation.
Goals	For the acquisition of knowledge, awareness and for self-treatment.
Settings	Places or situations that can trigger social anxiety e.g. workplace.
Levels	Level 1, Level 2, Level 3, Level 4 and Level 5.
Platform	Computer
Game Engine	Unity

The prototype development phase consists of low fidelity prototype and high fidelity prototype development. For low fidelity prototype design, it involves a visualization process of the serious game to be developed. The result of the low fidelity prototype design is a storyboard, which is used as pre-visualizations of games arranged according to the game-level storytelling sequence.

The production of game design documents was done at an early stage to provide an overview of the game concept that is used as a guide in the production of high fidelity game prototypes. The game design document covers a brief overview of the game, consisting of the genre, storytelling, goals, setting, levels, platforms, and game engine. Table 4 shows the items in the game design document.

The content and level of the game were designed according to the needs of the game to manage SAD through CBT. The content of the game consists of two parts, namely the social phobia scenario and the therapeutic plan. Meanwhile, the game level is divided into five stages, where the first level is an introduction to character and SAD; the second is knowledge sharing of the symptoms of social phobia and safety behavior; the third level is the implementation of cognitive therapy; the fourth is the implementation of behavioral therapy; and the fifth level is regarding relapse prevention.

In order to verify the framework implemented in prototype, effectiveness evaluation and usability evaluation need to be conducted to the target users.

Implementation of framework in social phobia game prototype

Prototypes are created by implementing the framework that has been developed. The prototype developed in this research is called the “Social Phobia Game”. This prototype was developed to provide an overview of social phobia and the application of therapeutic methods to treat, assist, manage the thoughts and behaviors of individuals with social phobia, as well as to provide education and awareness on social phobia. Players have to follow the sequence of levels from level one to level five to understand the storytelling of the main character and accomplish the game’s goals.

a. Mapping social phobia scenario elements (Social situations, Symptoms and Safety Behaviors) as game narrative

In this game, the narrative is implemented in the form of text. The context of the storytelling in the form of a narrative is used to convey the content of storytelling and at the same time allows the player to add knowledge, and understand the situation and the goals of the game. The context of the storytelling encompasses the feelings, behaviors, symptoms, and safety behaviors of the phobia patient. In addition, players can understand and learn about SAD and individuals with social phobia.

Social situations are simulated to describe the situation of individuals who have SAD in social situations. Visualization of SAD patients is illustrated through the characterization of the main character. A social phobia patient will show symptoms and behaviors of social anxiety when in a social situation. Social anxiety symptoms and behaviors are response mechanisms when social phobia patients are in a social situation that triggers their fears. The implementation of social situation elements, symptoms, and safety behaviors is shown in Figure 3.

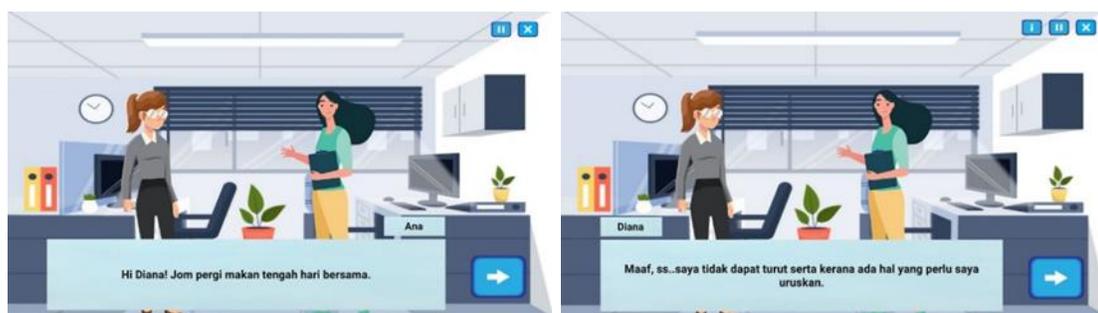


Figure 3. Interface of social situations, symptoms and safety behaviors

Social phobia symptoms are divided into three, namely behavioral symptoms, cognitive symptoms, and somatic symptoms (Kashdan & Herbert, 2001). These symptoms are triggered if the individual is in a social situation that is considered a burden that gives them discomfort. The level of symptoms shown by individuals with social phobia is different, ranging from mild to severe, as it is closely related to the type of social situation faced.

Behavioral symptoms are depicted in prototype as avoidance of social situations such as conversations and meetings. Somatic symptoms are stimulation through the autonomic nervous system that depicts as increased heart rate, trembling, and flushed cheeks (Heiser et al., 2009). Moukheiber et al. (2010) found that individuals with social phobia had difficulty to make eye contact compared to individuals without social phobia. Whereas, cognitive symptoms are negative or irrational thoughts when in social situations (Beidel et al., 1985).

According to Salkovskis (1991), safety behavior is an action to save oneself from negative evaluation when in a stimulus or anxiety situation. Meanwhile, Moscovitch (2009) states that safety behavior is a conscious action to avoid public exposure and public criticism. Safety behavior is one of the factors that maintain social phobia because individuals with social phobia have a high tendency to show safety behavior as a way to protect themselves from their self-claim danger. In the prototype, safety behavior is portrayed as shifting or avoiding eye contact when interacting, speeding up speech, speaking quickly without pauses, and shortening the speech.

b. Mapping social phobia scenario elements (Assumptions Activation and Negative Cognitions) as game challenges

The challenge element is implemented through safety behavior analysis. Players need to identify the correct safety behavior based on the social situation the main character is going through a given choice of questions. The narration of social situations and safe behaviors was done first before the players answer the questions given. Figure 4 shows the implementation of the challenge element in a game prototype.



Figure 4. Safety behavior question interface

Negative assumption and cognitive activation indicate mental thought and judgment processes when in social situations. According to Hodson et al. (2008), social phobic patients tend to have excessive negative thoughts in social situations because they think too much about others' impressions on them. Phobia patients have the assumption that social situations are unsafe and bring discomfort to them. Various assumptions arise in the minds of social phobia patients while in stimulus situation. The implementation of the negative thinking element in the game prototype was intended to show that negative thoughts sometimes appear automatically and that patients cannot control their thoughts while in feared social situations.

c. Mapping therapeutic elements (relaxation training, cognitive restructuring, social skills training) as game motivation

The motivational element is translated in the form of rewards. Rewards are given to player as encouragement. The formation and increase of self-confidence of social phobia characters are also a form of reward given as a marker of outcomes from cognitive and behavioral training.

Relaxation exercises aim to highlight methods to reduce anxiety and help in reducing the negative thought patterns. The relaxation exercise used is the “4-2-6 breathing technique” (Kaushik et al., 2006). The breathing technique is started by inhaling for 4 seconds, holding the breath for 2 seconds, and exhaling for 6 seconds. The graphic backgrounds on the other hand use soothing colors such as white and green. Figure 5 shows the interface of the relaxation training elements.



Figure 5. The interface of the relaxation training

Cognitive restructuring is the process of identifying, evaluating, and changing the patient's negative thoughts and beliefs about social situations (Wenzel, 2017). Cognitive restructuring are applied through the use of healthy thinking journals. Healthy thinking journals are used to identify and focus negative thoughts that want to be changed. Players will be asked to focus their thoughts and think of the change that they want. Players are encouraged to write down any changes they would like to achieve to help focus on rational and positive thinking.

Social skills training is done through the interpretation and analysis of negative thoughts and beliefs. This is important to help change individual's negative thoughts and beliefs related to social situations into rational ones. In addition, the elements of social skills are used to help create normal and appropriate behaviors based on the social situations experienced by social phobia patients. The analysis was done through a series of questions posed in the prototype to show that the assumptions of social phobia patients were negative in nature. The result of social skills training is to form new perspectives on social situations.

d. Mapping therapeutic elements (Social Assessment Exposure and Relapse Prevention) as game goals

The goals element is implemented in the game prototype as game objectives. The main objective of this prototype is to teach ways to change the thinking and behavior of individuals with social phobias that can be used as self-treatment. The goals of the game are clearly displayed on the game interface to make it easier for the player to understand the objectives of the game.

Exposure therapy is to measure the patient's ability to deal with social situations. According to Hofmann (2000), exposure therapy can reduce negative thoughts about oneself and effectively reduce social anxiety. The social assessment is applied in the game in the form of exposure to social situations such as in offices and public places. Disclosure of social assessment is also intended to help produce rational thoughts and responses. Figure 6 shows the elements of social assessment exposure.

Relapse prevention is a precautionary measure if there is a recurrence of social phobia symptoms. Relapse prevention can be done by honing coping skills and challenging oneself to face problems and difficult situations (Overholser, 2002). The relapse prevention element is implemented in the game prototype in the form of encouragement to foster the ability to challenge oneself to cope with social situations through continuous self-management and through new, healthier thinking.



Figure 6. Interface of social assessment exposure

Experiment design

The evaluation of the Social Phobia Game prototype was conducted on 18 respondents (8 males; 10 females). The average age of the selected respondents average age are 16 years old and each evaluation session took approximately one hour. The evaluation of the game prototype is carried out through an evaluation of its effectiveness and usability. This study used the same respondents for both types of evaluation. Figure 7 shows the evaluation procedure carried out on the respondents.

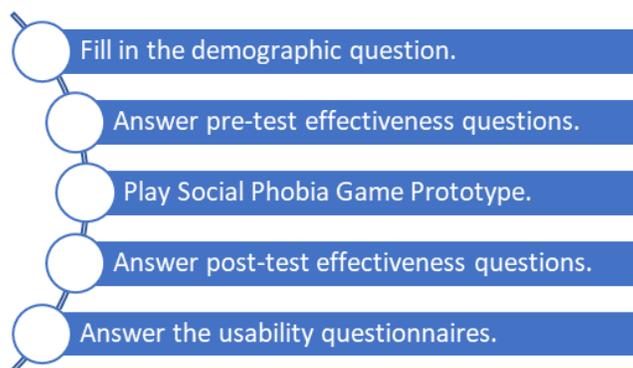


Figure 7. Evaluation procedure

Effectiveness evaluation are conducted to assess respondents' knowledge and to assess the effectiveness of social phobia games. The effectiveness test is divided into two parts, namely pre-test and post-test. Each pre-test and post-test had 15 items regarding social phobia. Pre-tests are conducted before the game was played by the respondents. This pre-test was conducted to assess the respondents' existing knowledge and understanding of SAD. Once the respondents finished answering the first part, the respondents had to play a social phobia game. The second part of the test was conducted after the game was played by the respondents. This aims to assess the respondents' knowledge improvement after finishing playing the game prototype.

Meanwhile, the usability assessment contained 30 items adapted from the research of Elaklouk and Zin (2017) and Lewis (2009). This usability evaluation was conducted after the respondents finished playing the game prototype to find out the respondents' feedback on the usability of the prototype. Table 5 shows the usability evaluation construct of the prototype.

Table 5. Constructs and usability evaluation items

Constructs	Total items	Number of items
Construct 1: Interface design	10	1-10
Construct 2: Ease of use	6	11-16
Construct 3: Ease of learn	3	17-19
Construct 4: Usefulness	6	20-25
Construct 5: Satisfaction	5	26-30
Total items	30	30

The usability evaluation of the prototype was measured based on five constructs, namely interface design, ease of use, ease of learn, usefulness, and satisfaction.

Before a usability evaluation could be conducted on the respondents, a pilot study was conducted to test the reliability of the usability instrument. The data obtained from the pilot study were analyzed to measure the internal consistency using the value of Cronbach Alpha coefficient. The Cronbach Alpha for the overall usability instrument is 0.96, which is considered a very good value. Table 6 shows the results of Cronbach Alpha values for each construct.

Table 6. Cronbach Alpha values for each construct

Constructs	Cronbach Alpha value
Interface design	0.86
Ease of use	0.87
Ease of learn	0.90
Usefulness	0.90
Satisfaction	0.70

The Cronbach Alpha value for each construct shows a reliability value between 0.90 to 0.70, which is in a very good level, and the usability instrument can be used in the evaluation towards targeted respondents of this study.

Results

The evaluation results showed good and positive feedback for the testing done on the game prototype. Data were analyzed to generate mean and standard deviation for effectiveness and usability evaluation.

Effectiveness evaluation

The effectiveness evaluation of the Social Phobia Game prototype was conducted through pre-game testing and post-game testing. The test conducted included 15 objective questions for each set of pre-test and post-test questions. The scores obtained by the respondents were calculated in percentage; dividing the total scores by marks obtained and then multiply the result with 100. Based on the pre-test results, the mean value of the pre-test score is 45.11. Meanwhile, the mean value of the post-test score was 60.39. The mean value of the post-test was higher than the mean

value of the pre-test. Table 7 shows the differences of mean values and standard deviations of pre-test and post-test.

Table 7. Mean values and standard deviations of pre-test and post-test

	Pre-Test	Post-Test
Mean	45.11	60.39
Standard deviations	15.94	19.48

The results of the effectiveness evaluation showed the difference of mean score between the pre-test and post-test by 15.28, and the post-test mean score was higher than the pre-test. This indicates an increase in knowledge among the respondents after using the game prototype.

Usability evaluation

Data analysis for usability assessment is using descriptive statistics through mean score values. The interpretation of the mean score is divided into three levels, which are low, medium, and high as shown in Table 8.

Table 8. Interpretation of mean score values

Mean score	Interpretation
1.00 – 2.33	Low
2.34 – 3.66	Medium
3.67 – 5.00	High

Source: Hadiyanto et al., 2013

Interface design construct are evaluated through 10 items. Overall, the interface design construct gave a high score that is the average mean score of 4.29 (standard deviation = 0.87). The results of the score analysis of the interface design construct found that the respondents agreed and were satisfied with the game interface design.

Ease of use construct are assessed through six items. Overall, the ease of use construct score was high in which the average mean score was 4.63 (standard deviation = 0.77). The results of the ease of use construct score analysis found that respondents agreed the game prototype was easy to use, and throughout the evaluation conducted, most respondents did not show difficulty in using the prototype.

Ease of learn construct are assessed through three items. Overall, the respondents gave a high score that is the average mean score of 4.63 (standard deviation = 0.78). The results of the ease of learn construct score analysis found that respondents agreed that the game prototype was easy to operate and learn.

Usefulness construct are assessed through six items. Overall, the respondents gave a high score that is the average mean score of 4.25 (standard deviation = 0.82). The results of the usefulness construct score analysis found that respondents agreed the game prototype could be used for the management of social phobia on its own.

Satisfaction construct are assessed through five items. Overall, the respondents gave a high score that is the average mean score of 4.41 (standard deviation = 0.70). The results of the satisfaction construct score analysis found that the respondents were satisfied with the game

prototype and considered it as fun. Table 9 shows the mean score values and standard deviations for each usability evaluation construct.

Table 9. Mean score values and standard deviations for each usability evaluation construct

Mean score	Mean	Standard deviations
Interface design	4.29	0.87
Ease of use	4.63	0.77
		cont...
		...cont
Ease of learn	4.63	0.78
Usefulness	4.25	0.82
Satisfaction	4.41	0.70

Discussion of findings

The validation of the framework is conducted through the development and evaluation of the Social Phobia Game prototype. The developed prototype consists of five game levels depicting social phobia patients and CBT interventions. CBT involves the implementation of elements such as breathing control training, cognitive restructuring, social skills training, and relapse prevention. The prototype is also design to encourage for self-management of social phobia and to be able to learn the techniques used in treating social phobia.

Game elements such as goals, motivations, challenges, and narratives are also implemented in game levels. Each level of the game has a different goal in imparting knowledge about social phobia management. The goal of the first level is to recognize and understand social phobia and social phobia patients. The aim of the second level is to learn about the symptoms and safe behaviors shown by social phobia patients when faced with social situations. The goal of level three is to transform negative thoughts into positive thoughts about social situations. The goal of level four is to teach normal and appropriate behavior in social situations. Meanwhile, level five aims to prevent relapse. The elements of goals, motivations, challenges, and narratives are applied as social and learning indicators.

Overall, the results of framework validation through game prototypes showed satisfactory results. The results of effectiveness evaluation through pre-test and post-test showed an increase of 15.28 and the post-test mean value readings are higher than the pre-test. An increase in the mean value in the post-test could indicate an increase in knowledge among the respondents after using the game prototype. Meanwhile, the usability evaluation showed a high average mean score for each construct of more than 4.00. There are improvements that need to be made through the ease of use construct on the item number 14 in which respondents suggested that manual should be included in the game to make it easier for players to use the game prototype.

Conclusion

Overall, this study has presented the use of CBT to identify, manage, and raise awareness of SAD. The framework can be used as a guide in serious game development and in the creation of game content. Each component in the framework was selected based on suitability and relatability in managing and treating SAD. In addition, the prototype interface design of the Social Phobia Game

can be used as a guide for designing and developing games. The framework and prototype have gone through validation and evaluation process to ensure their eligibility as assertive tools for SAD. The framework and prototype can be useful to assist researchers, designers, and game developers to develop serious games-based therapy related to mental disorders.

Acknowledgement

This research project was made possible through funding from the ‘Geran Universiti Penyelidikan’ Research Grant, with the grant code GUP-2019-059 conferred by the Centre for Research and Instrumentation Management (CRIM), Universiti Kebangsaan Malaysia.

References

- Albala, S. A., Kasteng, F., Eide, A. H., & Kattel, R. (2021). Scoping review of economic evaluations of assistive technology globally. *Assistive Technology*, 33(Suppl. 1), 50–67. doi: 10.1080/10400435.2021.1960449
- Alexiou, A., & Schippers, M. C. (2018). Digital game elements, user experience and learning: A conceptual framework. *Education and Information Technologies*, 23, 2545–2567. doi: 10.1007/s10639-018-9730-6
- Ambusaidi, A., Al-huseini, S., Alshaqsi, H., Alghafri, M., Chan, M., Al-sibani, N., ... Qoronfleh, M. W. (2022). The prevalence and sociodemographic correlates of social anxiety disorder: A Focused National Survey. *Chronic Stress (Thousand Oaks, Calif.)*, 6, 24705470221081215. doi: 10.1177/24705470221081215
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5* (5th ed.). Arlington, VA: American Psychiatric Association.
- Baharum, A., Bahar, I. A. A., Fatah, N. S. A., Ismail, R., Hanapi, R., & Fabeil, N. F. (2018). Serious game for phobia treatment in Malaysia. *Advanced Science Letters*, 24(3), 1823–1828. doi: 10.1166/asl.2018.11169
- Báldy, I. D., Hansen, N., & Bjørner, T. (2021). An engaging serious game aiming at awareness of therapy skills associated with social anxiety disorder. *Mobile Networks and Applications*, 26, 2087–2098. doi: 10.1007/s11036-021-01743-3
- Beidel, D. C., Turner, S. M., & Dancu, C. V. (1985). Physiological, cognitive and behavioral aspects of social anxiety. *Behaviour Research and Therapy*, 23(2), 109–117. doi: 10.1016/0005-7967(85)90019-1
- Bharadwaj, P., Pai, M. M., & Suziedelyte, A. (2017). Mental health stigma. *Economics Letters*, 159, 57–60. doi: 10.1016/j.econlet.2017.06.028
- Borg, J., Zhang, W., Smith, E. M., & Holloway, C. (2021). Introduction to the companion papers to the global report on assistive technology. *Assistive Technology*, 33(Suppl. 1), 1–2. doi: 10.1080/10400435.2021.2003658
- Carrión, M., Santorum, M., Benavides, J., Aguilar, J., & Ortiz, Y. (2019). Developing a virtual reality serious game to recreational therapy using iPlus Methodology. *International Conference on Virtual Reality and Visualization (ICVRV)*, 133–137. doi: 10.1109/ICVRV47840.2019.00031

- Clark, D. M., & Wells, A. (1995). A cognitive model of social phobia. In R. G. Heimberg, M. R. Liebowitz, D. A. Hope, & F. R. Schneier (Eds.), *Social Phobia: Diagnosis, Assessment, and Treatment* (pp. 69–93). New York, NY, US: The Guilford Press.
- Cruz-Lara, S., Fernandez-Manjon, B., & de Carvalho, C. V. (2013). Innovative approaches to serious games. *IEEE Revista Iberoamericana de Tecnologias del Aprendizaje*, 8(4), 163–165. doi: 10.1109/RITA.2013.2284954
- De Lope, R. P., Medina-Medina, N., Soldado, R. M., García, A. M., & Gutiérrez-vela, F. L. (2017). Designing educational games: Key elements and methodological approach. *2017 9th International Conference on Virtual Worlds and Games for Serious Applications (VS-Games)*, 63-70. doi: 10.1109/VS-GAMES.2017.8055812
- Dondlinger, M. J. (2007). Educational video game design: A review of the literature. *Journal of Applied Educational Technology*, 4(1), 21–31.
- Donker, T., Van Esveld, S., Fischer, N., & Van Straten, A. (2018). OPhobia - towards a virtual cure for acrophobia: Study protocol for a randomized controlled trial. *Trials*, 19(1), 433. doi: 10.1186/s13063-018-2704-6
- Donker, T., Van Klaveren, C., Cornelisz, I., Kok, R. N., & van Gelder, J.-L. (2020). Analysis of usage data from a self-guided app-based virtual reality cognitive behavior therapy for acrophobia: A randomized controlled trial. *Journal of Clinical Medicine*, 9(6), 1614. doi: 10.3390/jcm9061614
- Drosos, V., Alexandri, A., Tsohis, Di., & Alexakos, C. (2018). A 3D serious game for cultural education. *2017 8th International Conference on Information, Intelligence, Systems and Applications (IISA)*, 1–5. doi: 10.1109/IISA.2017.8316442
- Elaklouk, A. M., & Zin, N. A. M. (2017). Design and usability evaluation of rehabilitation gaming system for cognitive deficiencies. *2017 6th International Conference on Electrical Engineering and Informatics (ICEEI)*, 1–6. doi: 10.1109/ICEEI.2017.8312454
- Fenn, K., & Byrne, M. (2013). The key principles of cognitive behavioural therapy. *InnovAiT*, 6(9), 579-585. doi: 10.1177/1755738012471029
- Gierk, B., Löwe, B., Murray, A. M., & Kohlmann, S. (2018). Assessment of perceived mental health-related stigma: The Stigma-9 Questionnaire (STIG-9). *Psychiatry Research*, 270, 822–830. doi: 10.1016/j.psychres.2018.10.026
- Hadiyanto, Mukminin, A., Makmur., Hidayat, M., & Failasofah. (2013). Teaching in a digital era: English lecturers' readiness toward the internet use in teaching and learning at selected higher education institutions in Indonesia. *Asia-Pacific Collaborative Education Journal*, 9(2), 113–124.
- Heimberg, R. G. (2002). Cognitive-behavioral therapy for social anxiety disorder: Current status and future directions. *Biological Psychiatry*, 51(1), 101–108. doi: 10.1016/s0006-3223(01)01183-0
- Heiser, N. A., Turner, S. M., Beidel, D. C., & Roberson-Nay, R. (2009). Differentiating social phobia from shyness. *Journal of Anxiety Disorders*, 23(4), 469–476. doi: 10.1016/j.janxdis.2008.10.002
- Hodson, K. J., McManus, F. V., Clark, D. M., & Doll, H. (2008). Can Clark and Wells' (1995) cognitive model of social phobia be applied to young people?. *Behavioural and Cognitive Psychotherapy*, 36(4), 449–461. doi: 10.1017/S1352465808004487
- Hofmann, S G, Asnaani, A., Vonk, I. J. J., Sawyer, A. T., & Fang, A. (2012). The efficacy of CBT: A review of meta-analyses. *Cognitive Therapy Research*, 36(5), 427–440. doi: 10.1007/s10608-012-9476-1

- Hofmann, S. G. (2000). Self-focused attention before and after treatment of social phobia. *Behaviour Research and Therapy*, 38(7), 717–725. doi: 10.1016/s0005-7967(99)00105-9
- International Organization for Standardization. (2011). *Assistive products for persons with disability - Classification and terminology (ISO Standard No. 9999:2011)*. Retrieved from <https://www.iso.org/obp/ui/#iso:std:iso:9999:ed-5:v1:en>
- Jefferies, P., & Ungar, M. (2020). Social anxiety in young people: A prevalence study in seven countries. *PLoS One*, 15(9), e0239133. doi: 10.1371/journal.pone.0239133
- Kashdan, T. B., & Herbert, J. D. (2001). Social anxiety disorder in childhood and adolescence: Current status and future directions. *Clinical Child and Family Psychology Review*, 4(1), 37–61. doi: 10.1023/a:1009576610507
- Kaushik, R. M., Kaushik, R., Mahajan, S. K., & Rajesh, V. (2006). Effects of mental relaxation and slow breathing in essential hypertension. *Complementary Therapies in Medicine*, 14(2), 120–126. doi: 10.1016/j.ctim.2005.11.007
- Layton, N., Bell, D., Buning, M. E., Chen, S., Ramos, V. D., Hoogerwerf, E., ... de Witte, L. (2020). Opening the GATE: systems thinking from the global assistive technology alliance. *Disability and Rehabilitation: Assistive Technology*, 15(5), 484–490. doi: 10.1080/17483107.2020.1738565
- Lewis, J. R. (2009). IBM Computer Usability Satisfaction Questionnaires: Psychometric evaluation and instructions for use. *International Journal of Human-Computer Interaction*, 7(1), 37–41. doi: 10.1080/10447319509526110
- Lim, W. K., & Logenthiran, T. (2016). Developing a strategical smart grid game and creating smart grid awareness through games. *IEEE PES Innovative Smart Grid Technologies Conference Europe*, 154–159. doi: 10.1109/ISGT-Asia.2016.7796378
- Lipsitz, J. D., & Schneier, F. R. (2000). Social phobia: Epidemiology and cost of illness. *PharmacoEconomics*, 18(1), 23–32. doi: 10.2165/00019053-200018010-00003
- Melfsen, S., Kühnemund, M., Schwieger, J., Warnke, A., Stadler, C., Poustka, F. & Stangier, U. (2011). Cognitive behavioral therapy of socially phobic children focusing on cognition: A randomised wait-list control study. *Child and Adolescent Psychiatry and Mental Health*, 5(1), 5. doi: 10.1186/1753-2000-5-5
- Moscovitch, D. A. (2009). What is the core fear in social phobia?. A new model to facilitate individualized case conceptualization and treatment. *Cognitive and Behavioral Practice*, 16(2), 123–134. doi: 10.1016/j.cbpra.2008.04.002
- Moukheiber, A., Rautureau, G., Perez-Diaz, F., Soussignan, R., Dubal, S., Jouvent, R. & Pelissolo, A. (2010). Gaze avoidance in social phobia: Objective measure and correlates. *Behaviour Research and Therapy*, 48(2), 147–151. doi: 10.1016/j.brat.2009.09.012
- Öst, L., & Clark, D. M. (2013). Part II Treatments principles, procedures and evidence base. In L. Öst, & D. M. Clark (Eds.), *Cognitive Behaviour Therapy for Dental Phobia and Anxiety* (pp. 89–107). doi: 10.1002/9781118499825.ch7
- Overholser, J. C. (2002). Cognitive behavioral treatment of social phobia. *Journal of Contemporary Psychotherapy: On the Cutting Edge of Modern Developments in Psychotherapy*, 32(2-3), 125–144. doi: 10.1023/A:1020534025102
- Panagiotakopoulos, T. C., Lymberopoulos, D. K., & Manwlessos, G. M. (2008). Monitoring of patients suffering from special phobias exploiting context and profile information. *2008 8th IEEE International Conference on BioInformatics and BioEngineering*, 1–6, doi: 10.1109/BIBE.2008.4696779

- Patel, A., Knapp, M., Henderson, J., & Baldwin, D. (2002). The economic consequences of social phobia. *Journal of Affective Disorders*, 68(2–3), 221–233. doi: 10.1016/s0165-0327(00)00323-2
- Pereira, G., Prada, R., & Paiva, A. (2014). Disaster prevention social awareness: The stop disasters!. Case study. *2014 6th International Conference on Games and Virtual Worlds for Serious Applications (VS-Games)*, 1–8. doi: 10.1109/VS-Games.2014.7012155
- Philbin-Briscoe, O., Simon, B., Mudur, S., Poullis, C., Rizvic, S., Boskovic, D., ... Skarlatos, D. (2017). A serious game for understanding ancient seafaring in the Mediterranean Sea. *2017 9th International Conference on Virtual Worlds and Games for Serious Applications (VS-Games)*, 1-5. doi: 10.1109/VS-GAMES.2017.8055804
- Powers, M. B., Sigmarsson, S. R., & Emmelkamp, P. M. G. (2008). A meta-analytic review of psychological treatments for social anxiety disorder. *International Journal of Cognitive Therapy*, 1(2), 94–113. doi: 10.1521/ijct.2008.1.2.94
- Rapee, R. M., & Heimberg, R. G. (1997). A cognitive-behavioral model of anxiety in social phobia. *Behaviour Research and Therapy*, 35(8), 741–756. doi: 10.1016/s0005-7967(97)00022-3
- Romera Sanchez, A. Y., & Kunze, K. (2018). Poster: FLAIR - Towards a therapeutic serious game for social anxiety disorder. *UbiComp/ISWC 2018 - Adjunct Proceedings of the 2018 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2018 ACM International Symposium on Wearable Computers*, 239–242. doi: 10.1145/3267305.3267558
- Salkovskis, P. M. (1991). The importance of behaviour in the maintenance of anxiety and panic: A cognitive account. *Behavioural Psychotherapy*, 19(1), 6–19. doi: 10.1017/S0141347300011472
- Shi, Y.-R., & Shih, J.-L. (2015). Game factors and game-based learning design model. *International Journal of Computer Games Technology*, 2015, Article 549684. doi: 10.1155/2015/549684
- Sun, A., Conde, S., & Elor, A. (2021). Increasing sociability in a virtual world: A serious game for social anxiety disorder. *2021 IEEE 9th International Conference on Serious Games and Applications for Health*, 1–5. doi: 10.1109/SEGAH52098.2021.9551867
- Wenzel, A. (2017). Basic strategies of cognitive behavioral therapy. *Psychiatric clinics of North America*, 40(4), 597–609. doi: 10.1016/j.psc.2017.07.001
- Williams, C., & Garland, A. (2002). A cognitive-behavioural therapy assessment model for use in everyday clinical practice. *Advances in Psychiatric Treatment*, 8(3), 172–179. doi: 10.1192/apt.8.3.172
- Wong, C. H., Sultan Shah, Z. U. B., Teng, C. L., Lin, T. Q., Majeed, Z. A., & Chan, C. W. (2016). A systematic review of anxiety prevalence in adults within primary care and community settings in Malaysia. *Asian Journal of Psychiatry*, 24, 110–117. doi: 10.1016/j.ajp.2016.08.020
- Yusof, N., Rias, R. M., & Yusoff, E. H. (2014). Serious games in mental health treatment: Review of literature. *Knowledge Management International Conference (KMICe)*, 595–599.