

CBT4Depression: A Cognitive Behaviour Therapy (CBT) Therapeutic Game to Reduce Depression Level among Adolescents

Norhana Yusof¹

School of Multimedia Technology
and Communication
Universiti Utara Malaysia, 06010
UUM Sintok, Kedah, Malaysia

Nazrul Azha Mohamed Shaari²

Faculty of Computer and
Mathematical Sciences
Universiti Teknologi MARA, 40450
Shah Alam Selangor, Malaysia

Eizwan Hamdie Yusoff³

Faculty of Medicine
Universiti Teknologi MARA
68100 Batu Caves, Selangor,
Malaysia

Abstract—Dropping out of depression treatment commonly occurs in the current psychotherapy treatment. Adolescents often find it difficult to express their thoughts and feelings clearly due to their developmental constraints. They also have trouble realising their behaviours as unhealthy or problematic. The use of therapeutic games in depression treatment among adolescents can enhance the engagement level. Indirectly, the issue of dropping out can be reduced among the adolescents. Therefore, this study aimed to improve engagement levels and reduce depression level among adolescents with depression by designing a therapeutic game. A prototype named CBT4Depression was developed in this study. A quasi experimental study was conducted to evaluate the developed therapeutic game and 115 adolescents were recruited to measure their depression level using CBT4Depression. Based on the findings from the evaluation process, it can be concluded that the CBT4Depression considered success to engage and reduce the depression level among adolescents.

Keywords—Therapeutic; game; depression; adolescents; cognitive behavior therapy

I. INTRODUCTION

In recent years, a markedly increased number of adolescents diagnosed with depression each year throughout the world. According to the World Health Organization (WHO), depression is one of the leading causes of illness and disability among adolescents aged 10-19 years [1]. This is, perhaps, not surprising that the statistics of suicide and homicide also increased in line with the numbers of depression, and have become the third-leading cause of death in 15-19-year-olds as reported by WHO. According to Hink et al., [2], this age group is 4 times more likely to die by committing suicide compared to other older adolescents.

As for the treatment, disturbed adolescents need to undergo a number of sessions in psychotherapy but the limitations in the current talk-based treatment may lead to negative experiences among the adolescents [3]. They also face difficulty expressing their feeling verbally and may also deny that they are suffering from depression [2]. Adolescents with depression also may have limited knowledge regarding depression, such as the differences between normal sadness

and depression, early symptoms and impacts that could affect their daily life. In addition, adolescents also have several barriers to seeking professional help or appropriate services such as financial problems, lack of knowledge in the help-seeking process, and their attitudes towards the psychological treatment [3], [4].

Afterwards, this problem could contribute to the higher possibility of dropping out of the treatment [5]. Being aware of the flaws in conventional psychotherapy, researchers and therapists started utilising the popularity of game technology as an assistive tool, also called therapeutic games. The rapid innovations and advances in information and communication technologies have brought a great positive impact on the gaming industry, especially among the young generation. They become very attached to digital games [6]. Psychotherapists have realised the advantages of using games as assistive tools in psychotherapy among young patients. The use of serious games is already being applied to various types of mental illnesses, such as anxiety, depression, phobia, panic disorder and eating disorder [7].

With the arrival of recent game technologies in this area, it can be seen a rapid proliferation of therapeutic games in psychotherapy practices. The advent of game technology has facilitated psychotherapists to have a better understanding of their patients, particularly adolescences. Furthermore, the level of relationship, or rather, engagement, between therapist and adolescent could be enhanced. One of the most intriguing aspects of therapeutic games is that they could promote patients' engagement and motivation during the treatment, and indirectly enhance the success rate of the therapeutic process.

In the earlier version of digital games, it is only used as entertainment tools. To date, digital or serious games are not only utilised in training but also in education, medical and military simulation. The popularity of serious games has grown extensively and is broadly accepted by various age groups, ranging from children to adults. Given the wide popularity and benefits that can be obtained from using serious games, this has increased the interest of researchers and health professionals in using serious games in treatments as assistive tools [8].

This study was funded by the Universiti Utara Malaysia through Journal Publication Fee Funding Scheme (SPYPJ).

Due to this growing demand, new alternative technologies for treatment and therapeutic support of various mental illnesses are being developed and implemented [9], [10]. Despite the broad range of effective treatments available for depression, there is still a need for more research to support their use in clinical treatments [11].

The use of games in healthcare settings has increased these past few years. The present studies also display the effectiveness of therapeutic games as an assistive aid in mental health interventions [12]. Moreover, recent research has shown that using games in psychotherapy can help establish the therapeutic relationship between two parties: therapist and patient. Successful psychotherapy depends on the positive progress of the correlation between these parties. This is because, most of the patients, usually involving children and adolescents, face problems with traditional psychotherapy [13]. It is difficult for young patients to develop an emotional connection with their therapist. Thus, it increases their resistance to sharing with the therapist. In turn, this difficulty could lead to unsuccessful treatment [14].

Utilising therapeutic games could provide rich experiences and is also capable of stimulating the motivation and engagement of patients, which are important during the psychotherapy session [15]. As an interactive medium, therapeutic games promise a viable, engaging and cost-effective approach that may benefit in reducing the stigma of mental illness [16]. Several therapeutic games have been purposely designed to enhance patients' motivation in order to support changes in their daily behaviour towards improving their quality of life. Therefore, a therapeutic game that is designed accordingly might increase one's intrinsic motivation and reduce reactance [17].

Several researchers have also proven that therapeutic game has a good prospect of supporting a higher level of cognition, for example, self-esteem, problem-solving, decision-making, cognitive and emotional skills [8]. Utilising therapeutic games in psychotherapy has already been proven as an efficient tool in supporting young patients during a psychotherapy session, capable of bringing positive changes to their mental health [18]. Hence, therapeutic games have high potential for improving health outcomes [13]. Playing games is synonymous with young patients, in which they can easily get immersed in the game. Hence, a strong relationship between therapist and patient can be built through this valuable tool.

A new style of communication between therapists and their patients can also be designed through therapeutic games, which can decrease face-to-face therapist contact [19]. This could very well contribute to a successful psychotherapy session. Activities involved in the session must be able to capture the attention of young patients. Thus, while they play and immerse in the game, they would give full attention to the game and forget that they are, in fact, in a psychotherapy session [20], [21]. At a certain point, they might even begin to feel comfortable with the psychotherapy environment and have no fear to express their feelings indirectly. Therefore, it is important for therapists to provide a convenient and safe environment during the therapeutic process [14].

II. RELATED WORK

In this section, the most related work in therapeutic games for mental illness and targeted to young people from year 2021 to 2022 were discussed and compared. Based on the reviewed previous studies, it have clearly shown that the use of gaming intervention for mental illness in young people can improve their quality of life and reduce the depression symptoms. A comparative analysis that involved the 10 recent works related to therapeutic games in depression was conducted as shown in Table I.

Based on the comparative study, it was found that the most therapeutic approach utilized in the therapeutic games is Cognitive Behavior Therapy (CBT). This approach already known as an effective treatment to treat various mental health problems [25]. Thus, this is the main reason why most of the studies are using the therapeutic approach. This approach is very suitable to use for various game genres or platform such as video games, mobile games, online games, and role playing games. In addition, CBT is an action-oriented therapy that makes it very suitable for therapeutic games.

TABLE I. COMPARATIVE ANALYSIS

Game	Type	Therapeutic Approach	Focus	Source
I- SPARX	Video Game	CBT	Psychoeducation	[22]
SPARX	RPG	CBT	Behaviour change and engagement	[23]
Pesky gNATs (Depression & Anxiety)	Computer Game	CBT	Emotional problems	[24]
REThink (Depression)	Online Game	CBT REBT	Increase resilience	[8]
Grow It! (Depression)	Mobile Game	CBT	Emotional dynamics	[25]
Horizon: Resilience	Mobile Game	CBT Positive Psychotherapy	Increase motivation, cognitive flexibility activation and positivity	[26]
Moving Stories	Mobile 3D Video Game	NA	Mental health literacy and stigma reduction	[27]
EmoTIC	Mobile Game	NA	Social-emotional programme	[28]
Merlynne	Role Playing Game	CBT	Peer-to-peer support	[29]
MT-Phoenix i	Mobile Game	CBT	Reducing depressive symptoms	[30]

Legend:

CBT: Cognitive Behaviour Therapy

REBT: Rational Emotive Behavioral Therapy framework

Although all the studies as tabled in Table I focus on various elements, it clearly can be seen that most of them focus on the reducing the depressive symptoms by providing skills and knowledge to the young people. This is because young people have lack of skills and knowledge to handle depression. They also have a negative stigma toward depression as mentioned by [27]. Therefore, it is important to provide relevant skills and essential information to the young people to help them handle the depressive symptoms.

Other than that, gamification elements in the therapeutic game is vital to enhance engagement among the adolescents. Although the number of therapeutic games are increasing but the use of gamification in therapeutic games still limited. This is supported by a study conducted by [29]. The use of gamification elements will be able to sustain engagement among the adolescents to complete therapeutic activities in the game. The most common problem in the current treatment is inability to engage young people to the treatment and this leads to the dropping out from the treatment. Thus, the gamification elements should be fully utilized to increase their engagement.

III. COGNITIVE BEHAVIOUR THERAPY

A broad range of therapeutic approaches is available for depression, but Cognitive Behaviour Therapy (CBT) has been the most widely used and extensively researched among young patients [25]. Fig. 1 describes the main components of this model.

This therapeutic approach is an effective intervention for improving coping strategies among adolescents. The effectiveness of CBT in treating depression among young patients is well-known and has been acknowledged by most therapists and researchers. To date, CBT has emerged as the 'gold standard' therapy approach for depression or even most mental illnesses [31]. In recent years, there is growing evidence for the efficacy of CBT on depression [32]. As depicted in Fig. 1, the components in CBT consist of: i) thoughts (how one thinks); ii) emotions (how one feels); and iii) behaviour (how one acts), combined to modify how adolescents think and react so as to eliminate negative thoughts.

The main aim of CBT is to assist patients in recognising their pattern of negative thinking, evaluating their validity, and replacing these faulty patterns with a more positive thinking style [33]. In the procedure of CBT with adolescents, therapists will observe and start analysing the patterns of thoughts, feelings and behaviour exerted by adolescents during particular events. This is done because therapists in CBT attempt to modify the ways adolescents think and feel in a more positive manner, which will be reflected in the behaviour exhibited by the patients in certain situations. Most importantly, CBT therapists would try to eliminate automatic negative thoughts that always influence the adolescents in their reactions.

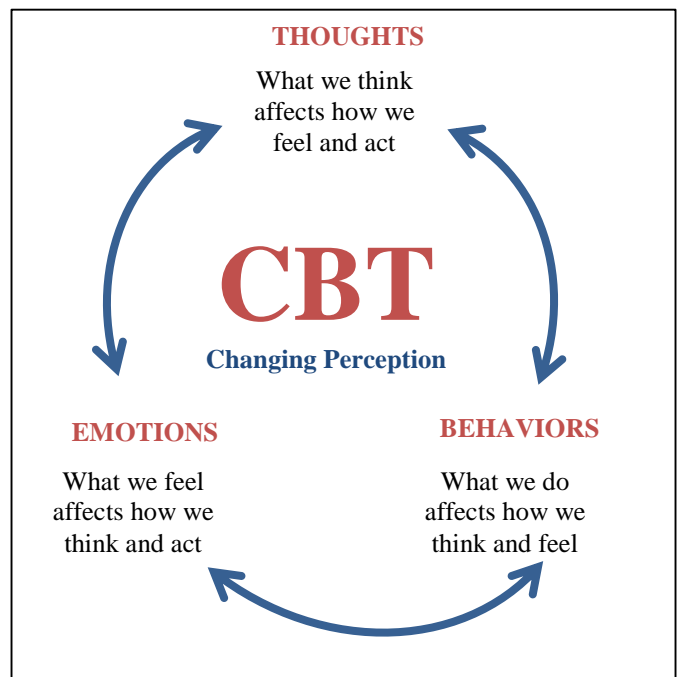


Fig. 1. Cognitive Behavior Therapy.

Now-a-days, CBT is widely utilised in therapeutic games that are designed for various mental illnesses, including depression [7]. This shows that the combination of CBT and therapeutic games can promote positive outcomes for people with depression, especially adolescents as tabled in Table I. To date, several therapeutic games were developed as an assistive aid to overcome the mental health illnesses. In this section, the study of the related works to therapeutic game discussed that focused on the reviewing the existing therapeutic game for mental illness.

IV. CBT4DEPRESSION

The findings from the comparative analysis that was discussed in Section II lead to the design and development decision of CBT4Depression. CBT4Depression is an interactive therapeutic game application designed to deliver CBT to depressed adolescents. The target users for CBT4Depression were defined as ranging from 13 to 16 years old, who could play and are usually interested in computer games. It is also the most common age group among adolescents that is always experiencing depression. This therapeutic game application was meant to be a therapeutic material that serves as a kit for therapists or tutorials for the targeted users.

As found in the comparative analysis, gamification elements embed in the therapeutic game. Thus, the concept of CBT4Depression was designed to be fairly simple in a 2D game environment with a single character game control. The aim of CBT4Depression was to serve as an assistive aid to target users in identifying and reducing their depression levels. This is because vast evidence portrays that many adolescents, especially at present times, have failed to realise that they are suffering from depression [34].

Through this prototype application, users can learn techniques to strengthen their basic life skills that are critical to hinder their depression from getting worse. The CBT4Depression was designed and developed in the Malay language to suit the target users, as recommended by mental health experts during the preliminary investigation. So far, most therapeutic games have been developed in the English language, such as SPARX [19] and Pesky gNATS [24]. Table II summarises the detailed description of CBT4Depression.

A. Therapeutic Elements

The CBT4Depression was designed based on a well-known therapeutic model named CBT, as described in Fig. 2. This model was chosen in this study because of its proven effectiveness in various mental health treatments. This model is also highly suitable for adolescents suffering from depression. CBT therapeutic strategies were applied to strengthen the elements of therapeutic game in CBT4Depression. The game highly focused on how to handle automatic negative thoughts and reactions.

TABLE II. DETAILED DESCRIPTION OF CBT4DEPRESSION

Main topic	Depression
Target users	Adolescents
Type	Single Player Role Playing Game (RPG)
Game graphics	2D Graphics
Concept	Therapeutic
Language	Malay
Depression Inventory	Beck Depression Malay
Objective	Beat Nega, collect points and escape from the jungle
Therapy Content	CBT, psychoeducation, and basic life skills

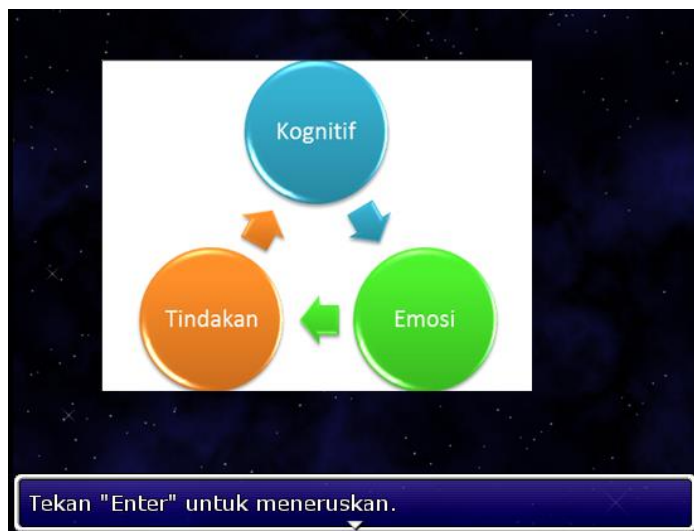


Fig. 2. CBT in CBT4Depression.

CBT4Depression helped the player recognise negative thoughts and poor reactions due to those thoughts. Thus, the therapeutic game embedded cognitive and behavioural techniques that are in line with CBT. Both techniques were implemented as part of the game elements and therapy content. Fig. 3 shows one of the cognitive techniques used in CBT4Depression, which is known as Socratic questioning.

Socratic questioning is an important component of CBT interventions that facilitates patients in assessing their automatic thoughts. It works by asking the player questions that encourage active participation in seeking answers and indirectly stimulating their critical thinking. Through this technique, the therapist can help patients become aware of and modify the process involved in their difficulties, and also learn how they can re-evaluate their thoughts.

Meanwhile, Fig. 4 describes one of the behaviour techniques called behaviour experiment, which was embedded in the therapeutic game. This technique was conducted after the player had learnt about negative thoughts and was used to evaluate underlying beliefs and assumptions.

The experiments were executed through questions and answers, writing notes on a certain given situation as an example and making predictions. Through these experiments, the player was encouraged to enhance the memory of the positive experience and avoid negative thoughts. Most of the existing therapeutic games for mental health apply these techniques in their games because such techniques are essential in psychotherapy [19], [35].

Besides, the use of a depression inventory was essential to measure the therapeutic outcome. A depression inventory is a set of self-rated questions used for assessing an individual's overall health condition related to depression symptoms [36]. In this study, the Beck Depression Inventory in Malay version (BDI-Malay) was utilized in the CBT4Depression. The BDI-Malay is suitable for adolescents because it is easy to understand. One example of the questions in the BDI-Malay is indicated in Fig. 5.



Fig. 3. Socratic Questioning.



Fig. 4. Behaviour Experiment.

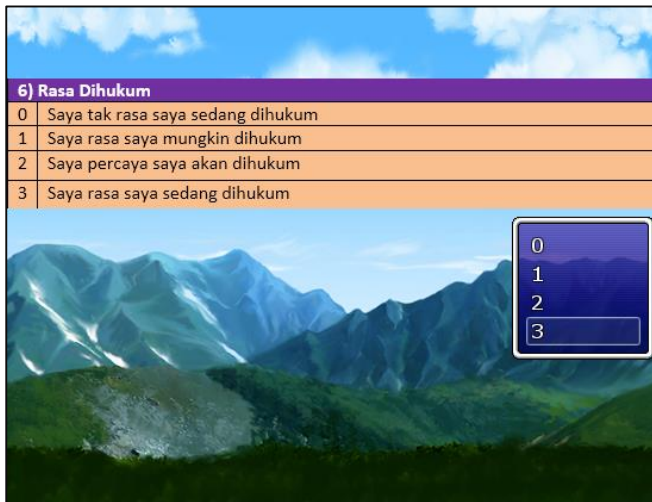


Fig. 5. BDI-Malay.

Other than that, psychoeducation was also embedded in the CBT4Depression to raise awareness among the target users. Concurrently, teaching critical basic life support skills in the therapeutic game application is also important in order to help target users cope with depression in certain situations. The life skills embedded in the CBT4Depression were problem-solving skill, decision-making skill, coping skill, relaxation skill, as well as communication and social skills. Similarly, existing therapeutic games that are designed for depressed adolescents also focus on comparable skills that cover cognitive, social and emotional skills for life and the school environment. The skills range from relaxation skills and literacy skills to emotion regulation skills [37].

B. Game Elements

The storyline embedded in CBT4Depression was about a teenager (player) who was lost while exploring the jungle. The player needed to find a small village far inside the jungle to seek help from the villagers to escape from the jungle. However, at the same time, the player needed to fight with some enemies, called Nega. Nega(s) were incarnations from

the player's own negative thoughts that appeared in various forms, such as a friend, stepmother or black shadow. Hence, the player had to defeat Nega by fighting negative thoughts and modifying them into positive thoughts.

Various elements of mixed fantasy and curiosity were used in the game story to ensure that CBT4Depression was capable of capturing the interest and attention of the player as depicted in Fig. 6. The story involved the elements of exploration or fantasy, which then lead to surprise, wonder, and awe, all of these supporting the fun elements.

In addition, the rules in CBT4Depression were clear and specific, thus, allowing a player to receive feedback discrepancies, which then can trigger greater focused attention and enhance player engagement. The linking activities provided in the prototype also contributed to engaging competitive and cooperative motivations. All these elements can help in enhancing the engagement level among adolescents.



Fig. 6. Game Elements.

The difficulty levels in CBT4Depression were designed to increase gradually from the first level onwards. The difficulty at each level was matched with the player's skills so that the player can complete all the challenges in the game. The challenges in the therapeutic game were also tested by the health experts during evaluation to ensure that the moderate challenges were suitable for the target players [38]. As the therapeutic game was targeted at adolescents with depression, the challenges were not too difficult and yet not too easy.

Besides, since CBT4Depression was purposely designed for people with depression, time challenge was not utilised in the game based on the advice of the experts. After all, failing to meet the challenge may cause the player to feel more depressed. The challenges at each level required the player to master different skills. The relevant skills used by the player can be practised outside the game context, facilitating an effective skill transfer in the player's daily life [39]. Once the player mastered the skills at a level, the difficulty of the challenge will be increased at the next level, and the player will then need to master a new skill to complete the challenge. The challenges at each level are listed in Table III.

TABLE III. GAME CHALLENGES IN CBT4DEPRESSION

Level 1	Exploration, survival, and accuracy
Level 2	Exploration, memorisation, defeating the enemies, and finding a key to open an exit door.
Level 3	Defeating the enemy and helping a friend
Level 4	Answering questions correctly, finding essential information, and defeating the enemies.

Meanwhile, Fig. 7 shows one of the game challenges that was designed in the therapeutic game. In this game challenge, the player will learn that negative thinking will lower their confidence level and indirectly lead them in making poor decisions. Therefore, this game challenge could help to increase their awareness of the importance to hinder negative thinking.



Fig. 7. Game Challenges in Level 1.

V. RESULTS AND DISCUSSION

In order to evaluate the effectiveness of CBT4Depression, a quasi-experimental study was conducted. The evaluation was adopted in this study to measure player experience in terms of engagement, as well as to test the effectiveness of CBT4Depression. The study was conducted in a lab environment with each PC installed with the CBT4Depression. Each participant in this study was assigned one PC.

A total of 115 adolescents aged between 13 and 16 were recruited in this study to measure their engagement level using CBT4Depression. The scores of BDI-Malay in the CBT4Depression were recorded and compared against the score classification, as indicated in Table III. The results demonstrated that the depression level of the respondents decreased from the pre to post-sessions. Then, the mean of the BDI score before and after using CBT4Depression was compared. Descriptive statistics for the two related samples were analysed, as presented in Table IV. The results showed that the mean for the BDI score after using the CBT4Depression was lower than the pre-score.

Nevertheless, the Paired Samples Test table was examined to ascertain whether the obtained result was significant or due to chance. Thus, the differences between the BDI score in both samples were examined for significance. As shown in Table V, the p-value was less than .05 (significance [2-tailed]). Referring to the results of the tests as shown in Table V and Table VI, it was found that the BDI scores reduced significantly after using CBT4Depression. Hence, this study has proven that therapeutic games support treatment for young people suffering from mental health, which is congruent to the findings of the study conducted by [13]. Therapeutic games can act as an alternative tools for psychotherapist in treating young patients such as children and adolescents. The information can be effectively delivered to them by using the therapeutic game as the medium of delivery.

TABLE IV. BDI SCORES CLASSIFICATIONS

Classification	Total Score	Pre-score	Post-score
Minimal Depression	0 - 9	-	79
Mild Depression	10 – 16	80	18
Borderline Clinical Depression	17 – 29	20	11
Moderate Depression	21 – 30	12	6
Severe Depression	31 – 39	3	1
Extremely Severe Depression	Over 40	-	-
Total		115	115

TABLE V. DESCRIPTIVE STATISTICS OF THE PAIRED SAMPLE (BDI SCORES)

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre score	12.9739	115	8.22647	.76712
	Post score	8.0783	115	8.41901	.78508

TABLE VI. PAIRED SAMPLES TEST RESULT USING CBT4DEPRESSION

		Paired Differences				t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower				Upper
Pair 1	Pre score – Post score	4.89565	6.84717	.63850	3.63078	6.16052	7.667	114	.000

In addition, it is evident that the therapeutic elements and game elements in CBT4Depression is effective in reducing depression level among adolescents. In other words, CBT4Depression can be used as an assistive tool in mental health treatment among young patients.

VI. CONCLUSION

This study has presented the effectiveness of CBT4Depression as a game-based digital intervention in reducing depression levels among adolescents. CBT4Depression comprises therapeutic elements that are adopted from a well-known therapeutic approach known as Cognitive Behaviour Therapy (CBT). In order to engage the adolescents in the game world, several game elements are applied in the game, such as challenge, curiosity, fantasy and fun. A quasi-experimental study has been conducted to measure the effectiveness of CBT4Depression. It has been found that CBT4Depression is effective in helping adolescents reduce their depression. Future work will involve expanding the CBT4Depression to cater more mental illness such as anxiety disorder, eating disorder and intermittent explosive disorders. The target groups will also expand to the adult as well.

ACKNOWLEDGMENT

This study was supported by the Universiti Utara Malaysia through Journal Publication Fee Funding Scheme (SPYPJ).

REFERENCES

- [1] World Health Organization, "Adolescent Mental Health," 2020. [Online]. Available: <https://www.who.int/news-room/factsheets/detail/adolescent-mental-health>. [Accessed: 13-Jun-2021].
- [2] A. B. Hink, X. Killings, A. Bhatt, L. E. Ridings, and A. Lintzenich, "Adolescent Suicide — Understanding Unique Risks and Opportunities for Trauma Centers to Recognize , Intervene , and Prevent a Leading Cause of Death," *Curr. Trauma Reports*, vol. 8, pp. 41–53, 2022.
- [3] R. Appleton, J. Gauly, F. Mughal, S. P. Singh, and H. Tuomainen, "Perspectives of young people who access support for mental health in primary care : A Systematic Review for Mental Health in Primary Care," *Br. J. Gen. Pract.*, vol. 72, no. 716, pp. E161–E167, 2022.
- [4] J. Goodwin, E. Savage, and A. O. Donovan, "I Personally Wouldn't Know Where to Go ": Adolescents' Perceptions of Mental Health Services," *J. Adolesc. Res.*, pp. 1–29, 2022.
- [5] S. O. Keffe, P. Martin, M. Target, N. Midgley, and G. A. Melvin, "I Just Stopped Going ": A Mixed Methods Investigation Into Types of Therapy Dropout in Adolescents With Depression," *Front. Psychol.*, vol. 10, no. 75, pp. 1–14, 2019.
- [6] N. I. Othman, N. A. M. Zin, and H. Mohamed, "Play-centric designing of a serious game prototype for low vision children," *Int. J. Adv. Comput. Sci. Appl.*, vol. 11, no. 5, pp. 199–205, 2020.
- [7] A. Dewhirst, R. Laugharne, and R. Shankar, "Therapeutic use of serious games in mental health : scoping review," *BJPsych Open*, vol. 8, no. 2, p. A238, 2022.
- [8] O. A. David, S. Magurean, and C. Tomoiaga, "Do Improvements in Therapeutic Game-Based Skills Transfer to Real Life Improvements in Children' s Emotion-Regulation Abilities and Mental Health? A Pilot Study That Offers Preliminary Validity of the RETHink In-game Performance Scoring," *Front. Psychiatry*, vol. 13, no. March, p. 828481, 2022.
- [9] M. Kowal, E. Conroy, N. Ramsbottom, and T. Smithies, "Gaming Your Mental Health: A Narrative Review on Mitigating Symptoms of Depression and Anxiety Using Commercial Video," *JMIR Serious Games*, vol. 9, no. 2, p. e26575, 2021.
- [10] J. Torous et al., "The growing field of digital psychiatry: current evidence and the future of apps, social media, chatbots, and virtual reality," *World Psychiatry*, vol. 20, no. 3, pp. 318–335, 2021.
- [11] M. Fitzgerald, B. Sc, M. Sc, G. Ratcliffe, B. Sc, and M. Sc, "Serious Games, Gamification, and Serious Mental Illness: A Scoping Review," *Psychiatr. Serv. Adv.*, vol. 71, no. 2, pp. 170–183, 2020.
- [12] M. Fitzgerald, B. Sc, M. Sc, G. Ratcliffe, B. Sc, and M. Sc, "Serious Games , Gami fi cation , and Serious Mental Illness : A Scoping Review," no. February, 2020.
- [13] H. Van Der Meulen, D. Mccashin, G. O. Reilly, and D. Coyle, "Using Computer Games to Support Mental Health Interventions : Naturalistic Deployment Study," *JMIR Ment. Heal.*, vol. 6, no. 5, p. e12430, 2019.
- [14] E. Wilmots, N. Midgley, L. Thackeray, S. Reynolds, and M. Loades, "The therapeutic relationship in Cognitive Behaviour Therapy with depressed adolescents : A qualitative study of good-outcome cases," *Psychol. Psychother. Theory, Res. Pract.*, 2019.
- [15] H. W. Wong et al., "Postsecondary student engagement with a mental health app and online platform (Thought spot): Qualitative study of user experience," *JMIR Ment. Heal.*, vol. 8, no. 4, pp. 1–12, 2021.
- [16] R. R. Wehbe et al., "Designing a Serious Game (Above Water) for Stigma Reduction Surrounding Mental Health: Semistructured Interview Study With Expert Participants," *JMIR Serious Games*, vol. 10, no. 2, p. e21376, 2022.
- [17] A. Fuchslocher, J. Niesenhaus, and N. Krämer, "Serious games for health: An empirical study of the game 'Balance' for teenagers with diabetes mellitus," *Entertain. Comput.*, vol. 2, no. 2, pp. 97–101, Jan. 2011.
- [18] D. Zayeni, J. Raynaud, and A. Revet, "Therapeutic and Preventive Use of Video Games in Child and Adolescent Psychiatry : A Systematic Review," *Front. Psychiatry*, vol. 11, no. 36, 2020.
- [19] T. M. Fleming et al., "SPARX-R computerized therapy among adolescents in youth offenders' program : Step-wise cohort study," *Internet Interv.*, vol. 18, no. September, p. 100287, 2019.
- [20] S. Henrich and R. Worthington, "Let Your Clients Fight Dragons: A Rapid Evidence Assessment regarding the Therapeutic Utility of 'Dungeons & Dragons,'" *J. Creat. Ment. Heal.*, vol. 00, no. 00, pp. 1–19, 2021.
- [21] J. Steadman, C. Boska, C. Lee, X. S. Lim, and N. Nichols, "Using Popular Commercial Video Games in Therapy with Children and Adolescents," *J. Technol. Hum. Serv.*, vol. 32, no. 3, pp. 201–219, 2014.
- [22] A. Thomas, Y. Bohr, J. Hankey, M. Oskaln, J. Barnhardt, and C. Singoorie, "How did Nunavummiut youth cope during the COVID-19 pandemic? A qualitative exploration of the resilience of Inuit youth leaders involved in the I-SPARX project," *Int. J. Circumpolar Health*, vol. 81, no. 1, 2022.
- [23] T. Fleming, M. Lucassen, K. Stasiak, K. Sutcliffe, and S. Merry, "Technology Matters: SPARX – computerised cognitive behavioural therapy for adolescent depression in a game format," *Child Adolesc. Ment. Health*, vol. 26, no. 1, pp. 92–94, 2021.
- [24] D. McCashin, D. Coyle, and G. O'Reilly, "Pesky gNATs for children experiencing low mood and anxiety – A pragmatic randomised controlled trial of technology-assisted CBT in primary care," *Internet Interv.*, vol. 27, no. December 2021, p. 100489, 2022.
- [25] E. Dietvorst, M. A. Aukes, J. S. Legerstee, A. Vreeker, and M. Micah, "A Smartphone Serious Game for Adolescents (Grow It! App): Development, Feasibility, and Acceptance Study," *JMIR Form. Res.*, vol. 6, no. 3, p. e29832, 2022.
- [26] Á. Gómez-cambronero, S. Casteleyn, and A. Mira, "Horizon : Resilience – Design of a Serious Game for Ecological Momentary Intervention for Depression," in *Extended Abstracts of the 2021 Annual Symposium on Computer-Human Interaction in Play (CHI PLAY '21)*, 2021, pp. 236–241.
- [27] A. Tuijnman, M. Kleinjan, M. Olthof, E. Hoogendoorn, I. Granic, and R. C. Engels, "A Game-Based School Program for Mental Health Literacy and Stigma on Depression (Moving Stories): Cluster Randomized Controlled Trial," *JMIR Ment. Heal.*, vol. 9, no. 8, p. e26615, 2022.
- [28] U. de la Barrera, E. Mónaco, S. Postigo-Zegarra, J. A. Gil-Gómez, and I. Montoya-Castilla, "EmoTIC: Impact of a game-based social-emotional

- programme on adolescents,” PLoS One, vol. 16, no. 4 April, pp. 1–17, 2021.
- [29] T. Chan, R. P. Gauthier, A. Suarez, N. F. Sia, and J. R. Wallace, “Merlynn: Motivating Peer-to-Peer Cognitive Behavioral Therapy with a Serious Game,” Proc. ACM Human-Computer Interact., vol. 5, no. CHIPLAY, p. Article 250, 2021.
- [30] G. Costikyan, “I Have No Words & I Must Design: Toward a Critical Vocabulary for Games,” in Proceedings of Computer Games and Digital Cultures Conference, 2002, pp. 9–33.
- [31] P. Srivastava, M. Mehta, R. Sagar, and A. Ambekar, “smartteen- a Computer Assisted Cognitive Behavior Therapy for Indian Adolescents with Depression- A Pilot Study,” Asian J. Psychiatr., p. 101970, 2020.
- [32] H. D. Hadjistavropoulos et al., “An Internet-Delivered Cognitive Behavioral Therapy for Depression and Anxiety Among Clients Referred and Funded by Insurance Companies Compared With Those Who Are Publicly Funded: Longitudinal Observational Study,” JMIR Ment. Heal., vol. 7, no. 2, p. e16005, 2020.
- [33] S. A. Bhat, “Cognitive Behavioral Therapy and Depression,” Int. J. Adv. Educ. Res., vol. 2, no. 6, pp. 143–145, 2017.
- [34] E. Eigenhuis et al., “Facilitating factors and barriers in help-seeking behaviour in adolescents and young adults with depressive symptoms: A qualitative study,” PLoS One, vol. 16, no. 3 March 2021, pp. 1–20, 2021.
- [35] H. van der Meulen, G. O’Reilly, and D. Coyle, “Including End-Users in Evaluating and Designing a Game that Supports Child Mental Health,” in Proceedings of the 2018 Annual Symposium on Computer-Human Interaction in Play Companion Extended Abstracts - CHI PLAY ’18 Extended Abstracts, 2018, pp. 655–659.
- [36] M. Okada, Y. Nakadoi, and A. Fujikawa, “Relationship between self-rated health and depression risk among children in Japan,” Humanit. Soc. Sci. Commun., vol. 9, no. 1, pp. 1–9, 2022.
- [37] T. Kuosmanen, T. M. Fleming, J. Newell, and M. M. Barry, “A pilot evaluation of the SPARX-R gaming intervention for preventing depression and improving wellbeing among adolescents in alternative education,” Internet Interv., vol. 8, pp. 40–47, Jun. 2017.
- [38] P. M. de Souza, K. R. da Hora Rodrigues, F. E. Garcia, and V. P. de Almeida Neris, “Towards a Semiotic-Based Approach to the Design of Therapeutic Digital Games,” in Digitalisation, Innovation, and Transformation. ICISO 2018. IFIP Advances in Information and Communication Technology, vol. 527, K. Liu, K. Nakata, W. Li, and C. Baranauskas, Eds. Springer International Publishing, 2018, pp. 53–62.
- [39] M. Poppelaars, A. Lichtwarck-Aschoff, M. Kleinjan, and I. Granic, “The impact of explicit mental health messages in video games on players’ motivation and affect,” Comput. Human Behav., vol. 83, no. 2018, pp. 16–23, 2018.