

# *Effects of Serious Games on Child and Adolescent Depression*

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**Abstract:** Depression is a serious problem that negatively affects people's mental health. The number of people suffering from depression of different degrees in the world is large and tends to be younger. The phenomenon has attracted the attention of many scholars to innovate treatment measures. There are not many effective ways to alleviate depression. The antidepressant effects of serious games have received increasing attention in recent years. This study seeks to review these articles published since 2018, examine their methodology, tests, and significant findings, and explore whether serious games are effective in relieving adolescent depression. The findings show serious games have enormous potential for stress and depression relief. Future studies should examine the lasting effects, much broader outcomes, and the potential side effects of serious games on reducing juvenile depression.

**Keywords:** effects, serious games, depression, children and adolescents

## 1. Introduction

Mental health, as an indispensable component of an individual's overall health, should be given equal attention as physical health. Globally, mental problems are extraordinarily widespread. An estimated one-eighth of the global population has a mental disorder, with depression and anxiety disorders being the most prevalent types. More than 300 million individuals suffer from depression [1]. The COVID-19 epidemic and the conflict in Ukraine have produced a worldwide mental health catastrophe, exacerbating short- and long-term anxiety and weakening the mental health of millions of people.

Children and adolescents, due to lower educational performance, low self-esteem or peer pressure, are easy to suffer from depression. Depression is often connected with other psychiatric conditions, including anxiety, schizophrenia and bipolar disorder. Globally, in 2019, 301 million individuals were dealing with anxiety, and 64 million with schizophrenia or bipolar illness [2]. Schizophrenia in its severe stages is the most debilitating of all diseases. People with schizophrenia or other major mental health illnesses pass away 10–20 years earlier than the average life expectancy [3].

Depression and associated mental disorders are the major causes of suicide, particularly among adolescents. Annually, 703,000 people commit suicide [4]. Since 58% of suicides happen before the age of 50, this results in a great loss for society's economy. It is believed that the most common mental diseases (depression and anxiety) bring about productivity loss and cost the global economy one trillion dollars a year [5].

Thus, it is vital to find measures to reduce depression and related mental problems. Psychotherapy, considered a crucial component of treatment, has been employed to alleviate depression symptoms.

Worldwide, although the child and adolescent demand for mental health care is strong, the supply is far from adequate and sufficient. Often, children and adolescents experience difficulties in access to psychotherapy, and even when they are able to obtain it, the therapy may be ineffective. Even the most effective (psychological or pharmacological) treatments prove to be successful in around 50% of depressed persons [6]. Other barriers, including lack of cognition of psychological health, stigma, and discrimination, prevent people from seeking treatment, especially among children and adolescents. There is an increasing belief that to alleviate juvenile depression. It is needed to develop more accessible and effective interventions that suit their features and can be accessed even when face-to-face interventions are not feasible or are not accepted due to fear of stigma and discrimination.

Several of the aforementioned hurdles can be overcome with the use of new technology. Delivering evidence-based treatment of mood and anxiety disorders through teleconferencing, mobile apps, or web-assisted therapy is an effective approach [7]. It has been demonstrated that video games offer considerable therapeutic potential for anxiety disorders [8]. According to a previous study, video games might effectively alleviate depression symptoms [9]. Another research proved the potential impacts of casual videogames on anxiety and depression [10]. Compared to commercial games and traditional treatment, serious games, whose primary objectives are learning and education, might be more effective in reducing depression. Also, research shows the potential for serious games to ease juvenile depression.

This study focuses on exploring the antidepressant potential of serious games, strives to explore recent research developments and sum up the evidence-based outcomes and significant findings.

## 2. Literature Review

The application of serious games is a rapidly evolving field of investigation. Serious game-based approaches for alleviating depression have garnered improvements, enabling reviews of serious games for depression and other mental conditions.

There were several reviews that covered this field. Most reviews had included peer-review articles published before 2018 (Table 1). Fleming et al. examined articles published from 2010 to 2016 that studied serious game interventions for mental problems [11]. Dias et al. analyzed 28 articles published from 2007 to 2016, which studied how serious games had been applied in depression care in various age ranges of the population [12]. Villani et al. investigated articles published from 2007 to 2017 to explore the potential of video games on emotional regulation and mental well-being [13]. Regarding children and adolescents, Barnes & Prescott conducted a systematic review of articles published from 2011 to 2016 concerning therapy for adolescent anxiety disorders [14]. David et al. studied articles published from 1989 to 2014 to evaluate the possible effect of serious games on juvenile mental wellness and behavioral enhancement [15].

Although these evaluations give vital information on game-based antidepressant therapy, the subject remains immature and further study is recommended to undertake, since evidence has been rather limited. Meanwhile, these findings may become obsolete since the use and access to serious games are growing and changing very rapidly. It is noteworthy that immersive gaming experiences and the interactive aspects of gaming have made significant strides. Similarly, research conducted during this period was not synchronized with the serious game of intervention in depression, especially when children and adolescents were focused. Serious games' application in depressive therapy in children and adolescents has been a rapidly developing field where timely updates are well demanded. There still lacks a more recent systematic review of the developments since 2018 within this rapidly growing field.

Here, this research aims to address the gap by reviewing the articles published since 2018 on serious game-based interventions for youth depression alleviation. The purpose was to examine their methodology, tests, and significant findings, to explore and assess whether serious games are

effective or not in relieving adolescent depression and to discuss the implications of the results for technology application, clinical practice, and future research.

Table 1: Previous reviews of serious games on psychological health.

Review	Years of publications	Study aim	Conclusion
Fleming et al., 2017	2010-2016	Investigating mental health with applications of serious games and gamification	Applied games offer significant promise for enhancing the efficacy of online mental health therapies.
Dias & Barbosa, 2018	2007-2016	To determine how serious games have been utilized to depression therapy	Mobile, computer, wearable, and internet applications were identified as technological tools for depression therapy. Serious games use these technologies. Several articles employed CBT as intervention, while others used gamification to encourage participation and treatment adherence.
Villani et al., 2018	2007-2017	To investigate possible effects of video games on emotional regulation.	Video games provide important options for emotional control and pose a challenge to educational and psychological therapies.
Barnes & Prescott, 2018	2011-2016	To explore gaming therapy against anxiety of adolescents	Serious games have the potential capacity to alleviate teenagers' anxiety.
David et al., 2020	1989 -2014	To study the possible antidepressant and behavioral enhancement effects of serious games in children and adolescents	It still lacks adequate evidence that serious games can serve as the prevention/treatment approach for juvenile depression.

### 3. Methodology

The author conducted automated searches of PsycInfo, Medline, and EMBASE using a mix of terms pertaining to serious games and depression. Only English peer-reviewed literature was included in this analysis. After obtaining the relevant articles, the author filtered duplicates, assessed the remained titles, checked the abstracts for specific relevance, and read the full-text articles. Given that this is an emerging and rapid-advancing field, the author included those articles that met the criteria as follows: (1) use of serious games; (2) focusing on anxiety or depression relief; (3) RCTs as the main technique; (4) children or teens as participants; (5) published in 2018 or later; and (6) publication in English and peer-reviewed journals.

#### 4. Argument and Discussion

Tables 2 and 3 provide a summary of the basic features and principal findings of the six included articles. All the research was conducted as random controlled trials (RCTs) in four countries. Two RCTs were conducted in The Netherlands, two in Romania, one in Pakistan and one in Canada. All trials had small-to-moderate sample sizes, with participants ranging from 11 to 70 per group. In addition, various measures were applied for the primary outcome, including SCAS, CES-DC, EATQ-R, CYRM-12, HSC, CESD-R and CERQ-short. Teachers, trained therapists or researchers performed gaming therapy, and the intervention often lasted for several weeks.

Table 2: Characteristics of included studies (N=6).

Study ID	Location	Experimental design	Age (years)	Sample size, n	Measure
Schoneveld et al, 2018 [16]	Netherlands	non-inferiority RCT	7-12	EG:86 CG:88	SCAS
David et al, 2019 [17]	Romania	RCT	10-16	EG:54 REBE group: 55 waitlists: 56	ETQ-R
Schoneveld et al, 2020 [18]	Netherlands	non-inferiority RCT	8-12	EG:86 CG:88	SCAS
Khan et al.,2022 [19]	Pakistan	RCT	10-19	60	CES-DC
David& Fodor,2022 [20]	Romania	RCT	10-16	EG:54 REBE group: 55 waitlists: 56	EATQ-R
Bohr et al, 2023 [21]	Canada	Pilot RCT	13-18	24	CYRM-12; HSC; CESD-R; CERQ-short

CES-DC: Center for Epidemiological Studies Depression Scale for Children

CESD-R: Centre for Epidemiological Depression Scale-Revised.

CERQ-short: Cognitive Emotion Regulation Questionnaire-Short.

CG: control group

CYRM-12: Child and Youth Resilience Measure(12-item).

EATQ-R: Early Adolescent Temperament Questionnaire-Revised

EG: experimental group

ETQ-R: Early Temperament Questionnaire-Revised

HSC: Hopeless Scale for Children.

REBE: Rational Emotive Behavior Education

RCT: randomized controlled trial

SCAS: Spence Children's Anxiety Scale

762 participants were involved in the RCTs in total. The sample sizes of Schoneveld et al. (N=174) and David et al. (N=165) were the biggest compared to the other studies, whose sample sizes varied from 24 to 60. The games used in the tests included MindLight, RETHink, 3D-GIT and Remission-II and SPARX.

Table 3: Games, estimated playing time, and conclusions of included studies (N = 6).

Study ID	Game	Estimated playing time	Conclusion
Schoneveld et al, 2018 [16]	MindLight (PC)	1-hour session every week, for 5 weeks	MindLight and CBT demonstrate equal effects in preventing anxiety with child reported anxiety decreasing at post-test. Based on family ratings of anxiety measures, three- and six-month follow-up evaluations suggested that intervention effects were sustained.
David et al, 2019 [17]	REThink (IPAD, online)	7 sessions of 50 min each	REThink could alleviate overall emotional symptoms and depressed mood and had a good influence on regulating emotions.
Schoneveld et al, 2020 [18]	MindLight (PC)	1-hour session every week, for 6 weeks.	MindLight was equally helpful as CBT in alleviating internalizing symptoms. CBT was more successful than MindLight at reducing externalizing symptoms. MindLight have the potential to be successful therapy not just for alleviating anxiety symptoms, but also for the improvement of broader mental health outcomes.
Khan et al., 2022 [19]	3D-GIT and Remission-II (PC)	four times every week during a month	3D-GIT and Re-Mission-2 have equally useful effects in alleviating young cancer patients' depression.
David & Fodor, 2022 [20]	REThink (IPAD, online)	seven levels; one level played twice; during four consecutive weeks	REThink had a lasting effect on the youngsters' emotional regulation. Trauma, parent psychological control and parent attachment were important moderating factors.
Bohr et al, 2023 [21]	SPARX (PC)	seven modules at 20 min each; one module played per week.	SPARX intervention reduces juvenile passive emotions such as hopelessness, self-blame, rumination and groundless fears. However, SPARX did not show significant effects in depression reduction or resilience improvement.

## 5. Strengths and Limitations

As shown in the review, six studies were published since 2018, which demonstrates the recent advances as well as increased research interest in the novel area of gaming intervention for youth depression. The included five studies show that serious games have great potential for alleviating depression or anxiety in young people, while one study did not demonstrate a reduction in depression symptoms.

Why do serious games have an effect on alleviating youth depression? Children and adolescents could regard serious games as a reward rather than treatment. That is why engagement and adherence may be maintained. In the study, serious games were embedded with various strategies, including

videos, mini-video games, or social interaction, to make themselves appealing to youth. Children and teens could be especially interested in the rewarding experience of playing video games. Mini-video games with specific psycho-educational content, such as coloring or exploring a dream world, can enhance coping abilities and boost motivation. Hence, games demonstrate effects on psychotherapy interventions with youth. CBT has been shown to be an effective antidepressant intervention [22]. Serious games, which incorporate CBT and establish the computerized version of CBT, have been proved to be helpful.

Several limitations exist with the study. First, the size of included articles is limited. As this study focuses specifically on the most recent developments since 2018, the quantity of studies covered is limited. Similarly, the sample sizes of included studies are small, with less than 100 participants for each group. The sample size hinders the validity of the evidence of serious games' effectiveness in youth depression. Second, despite the non-significance of baseline differences, studies seldom reported credibility or expectation ratings, which are actually essential when evaluating possible placebo effects, since the act of playing or even the expectation of playing a calming game can occasionally ease minor depression. Finally, the study often had inconsistent and short follow-up periods. Whether the long-term effects of gaming interventions will be maintained still remains unknown.

### **5.1. The Implications for Technology**

This review updates the advances in the field and contributes more reliable evidence to better understand the efficacy of game-based antidepressant intervention in children and adolescents. The interactive feature and social component could be important factors that contribute to the effectiveness. Therefore, gaming interventions may attach great importance to the game's affinity for young people, making the games appealing and attractive to them so that the children and adolescents are more willing and active to engage in technology-based therapeutic interventions and the drop-out rate will be decreased. The highly interactive feature of serious games will make it helpful and successful in alleviating depression since human interaction is limited.

Meanwhile, it is highly recommended to cooperate with youth communities in developing more tailored serious games to suit the conditions of children and adolescents. To make the serious games more inclusive, the cultural, ethnic and customs perspectives of users are also recommended to be embedded in the serious games.

### **5.2. The Implications for Clinical Practice**

Psychopharmacological therapy and psychotherapeutic maintenance are the cornerstones of depression management, and serious game-based interventions can not replace their dominant position. However, serious games bear obvious and particular benefits and could serve as an add-on to conventional interventions. Serious games are not confined to face-to-face counselling and can be conducted online. People in far-remote areas can also access serious games as a treatment, which will help to narrow the gap of mental healthcare provision between remote regions and urban centers. Serious games can also be provided to people residing in restricted regions such as the case in Covid-19 pandemic. During that period of time, people were more vulnerable than ever before and depression was more common among various groups, not just children and adolescents. Mental health interventions were urgently needed. It was impossible or inconvenient to deliver face-to-face consultation and intervention during the lockdown periods. Under those circumstances, serious games display the advantage of providing a better approach to ensure easy and convenient access online to reduce mental health problems. Compared with traditional treatment, serious games are cheaper and more convenient to conduct.



Another important question to consider in applying serious games in clinical practice is which group and what kind of depression could get more benefits from gaming intervention. As far as the group is concerned, children and adolescents with high literacy in the internet and games may be the optimal target group, although studies also prove the effectiveness of serious game-based intervention in senior adults [23]. In terms of depressive disorder, serious games may be more beneficial for milder or reactive depression as well as depression in a more stable phase.

### 5.3. The Implications for Future Research

Although definitive conclusions cannot be drawn, utilizing serious games to alleviate juvenile depression is a promising method with great potential for enhancement. In light of the findings, the recommendations for further study are provided in this review. First, more research should be done focusing on key factors as well as mechanisms of gaming intervention effects such as user-friendliness, degree and forms of social interaction, and the levels of immersion in serious games. Second, more research should be done to incorporate user feedback-young people's views and expectations toward the games for the benefits of feasibility and acceptability. Third, further large-scale trials with long periods and frequent follow-ups are needed to investigate the lasting efficacy of gamification in relieving juvenile depression. Fourth, the current studies mainly focus on young and elderly people. Future research should evaluate the efficacy of game-based therapy among other age groups of the population to provide more scientific evidence for the intervention. And more comparative studies should be done to deepen the understanding of the antidepressant effects of serious games. Fifth, future studies should examine the broader outcomes of serious games, such as the improvement of youths' quality of life, as compared to the effects of particular depression or anxiety symptoms. Finally, since youth are more likely to abuse games and there may be potential side effects in the application of serious games as intervention vehicles, more research should be conducted to assess and analyze the possible side effects, such as the abuse of serious games in youth depression prevention and treatment.

## 6. Conclusions

Utilizing serious games to alleviate depression in young people seems feasible. Given the limited number of trials and evidence, this study can only provide a basic view of the future prospects of serious games for teenage depression intervention. To determine the longer-term and lasting effects of serious games on depression alleviation, more RCTs need to be conducted. Future research should not lose sight of technical advancement. Research on the underlying vital factors and mechanisms of gaming intervention effects should also be highlighted. Further studies ought to investigate the broader outcomes, the effects among more age groups and the potential side effects for depression alleviation.

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