

'I Can't Get No Satisfaction'... Experience in the treatment, satisfaction, and professional support of young depressed people using SPARX

SASHA DEL VECCHIO¹, SILVIA MAMMARELLA¹, LAURA GIUSTI¹, MASSIMO CASACCHIA¹, RITA RONCONE¹

¹Department of Life, Health and Environmental Sciences, University of L'Aquila.

Summary. Aim. Depression in young people is common and can lead to poor long-term outcomes. Digital therapies are a promising means of promoting access to care. Currently, among the digital treatments for depression in adolescents recognized by the NICE guidelines, there is SPARX (Smart, Positive, Active, Realistic, X-factor), based on Cognitive Behavioral Therapy, CBT. This narrative review aimed to evaluate: 1) Who were the depressed young people who used SPARX and what was their experience with the treatment? 2) Were users satisfied with the SPARX treatment? Did the youth's perceived level of satisfaction with using SPARX impact completion rates? 3) What was the role of professionals (researchers, consultants, teachers) in the SPARX studies? Has their support in running SPARX affected completion rates? **Methods.** A narrative review of the English literature was performed. The articles were searched in Pubmed, SCOPUS, and Web of Science databases (from 2012 to 2023) with keywords such as 'SPARX,' 'depression' and 'young adult'. **Results.** Of 557 papers, 18 were included in our review. The young people who used SPARX were students or adolescents from special help-seeker populations at risk or with mild to moderate depression. The highest satisfaction levels were present in users of primary health services, such as general practice and counseling services. The support of the school counselor and experts in mental health clinicians was instrumental in impacting user satisfaction and completion rates. The personalization of the game in terms of user culture - symbols, language, norms, values, and artifacts; the customization of the avatar, the gender identity; the narrative structure; the presence of a guide character (virtual therapist); the CBT homework seemed to represent crucial SPARX characteristics related to satisfaction and completion rates. **Discussion and conclusions.** Our narrative review provides an overview of the main results of using SPARX with interesting considerations that may suggest improvements for broader use and diffusion of this digital treatment.

Key words. Adolescent, cognitive-behavioral treatment, depression, gamification, SPARX, treatment adherence, young adult.

"I Can't Get No Satisfaction"... Esperienza nel trattamento, soddisfazione e supporto professionale di giovani depressi che utilizzano SPARX.

Riassunto. Scopo. La depressione nei giovani è comune e può comportare esiti non soddisfacenti a lungo termine. Le terapie digitali rappresentano uno strumento promettente per l'accessibilità alle cure nel campo della salute mentale. Attualmente le Linee Guida NICE includono SPARX (Smart, Positive, Active, Realistic, X-factor) tra i trattamenti cognitivo-comportamentali digitali per il trattamento della depressione negli adolescenti. Questa revisione narrativa mira a valutare: 1) "Chi sono i giovani depressi che utilizzano SPARX e qual è la loro esperienza con il trattamento?" 2) "Gli utenti sono soddisfatti del trattamento SPARX? Il livello di soddisfazione percepito dai giovani ha influito sui tassi di completamento?" 3) "Qual è stato il ruolo dei professionisti negli studi SPARX? Il loro supporto ha influito sui tassi di completamento?". **Metodi.** È stata eseguita una revisione narrativa della letteratura in lingua inglese. Gli articoli sono stati ricercati nei database Pubmed, SCOPUS e Web of Science (dal 2012 al 2023) con parole chiave "SPARX, "depressione" e "giovani adulti". **Risultati.** Su 557 lavori, 18 sono stati inclusi nella revisione. I giovani che hanno utilizzato SPARX erano studenti o adolescenti provenienti da popolazioni a rischio o help-seekers con depressione da lieve a moderata. I più alti livelli di soddisfazione erano presenti negli utenti dei servizi sanitari di base, come i servizi di medicina generale e di counseling. Il supporto dello psicologo scolastico e dei professionisti della salute mentale sembra determinante nell'influenzare la soddisfazione degli utenti e i tassi di completamento del trattamento. L'adesione a SPARX includeva anche la personalizzazione del gioco, in termini culturali e di identità di genere, una struttura narrativa, l'inclusione di una guida virtuale, i "compiti a casa" assegnati nel percorso terapeutico. **Discussioni e conclusioni.** La revisione narrativa condotta fornisce una panoramica dei principali risultati dell'utilizzo di SPARX con interessanti considerazioni che possono suggerire miglioramenti per un uso e una diffusione più ampi di questo trattamento digitale.

Parole chiave. Adesione al trattamento, adolescenti, depressione, gamification, giovani adulti, SPARX, terapia cognitivo-comportamentale.

Introduction

Due to the recent pandemic related to Covid-19, there has been an increase in depressive and anxiety

disorders in the world population. Recently, the 2022 World Health Organization Mental Health Report¹ reported a rise in depression of 28% compared to pre-pandemic data.

A similar trend was found among young people², with the adolescent population representing the most affected by emotional disorders^{3,4}. Rapid physical, psychological, and social changes and a period of greatest vulnerability to the onset of mental disorders characterize adolescence. Adolescents are becoming adults and more willing to make crucial decisions and life choices. Despite suffering severe psychological distress, they find it challenging to ask and to get or to adhere to psychological or psychiatric treatments. According to the literature, approximately a third of adolescents do not complete the recommended psychosocial or psychopharmacological therapies⁵⁻⁸. Many factors have been identified to overcome barriers to treatment adherence. Factors that positively impact compliance with adolescents treatment can be divided into factors mainly related to the therapeutic setting and the external social context⁶. Among the former, effective physician-patient communication was identified⁹; positive beliefs about and, therefore, acceptance of the prescribed treatment; non-judgmental setting; more contact with mental health professionals and better-planned appointments; involving adolescents in the development of their mental health care; suitable and planned patient psychoeducation; taking into account patient expectations; establish active physician-user cooperation. Furthermore, among the factors implicated in the social context, it was highlighted how higher levels of education and the family's socio-economic status seem to be positively correlated with the adherence of adolescents. On the contrary, low solidarity among the family or close friends negatively influenced treatment adherence⁶.

Digital Mental Health (DMH) appears to be a promising solution to improve access to mental health services^{10,11} and to overcome barriers of adherence and stigma¹². DMH is a term used to indicate all technologies used in the mental health field to make diagnoses, monitor the subject's clinical conditions, and support the healthcare professionals' decisions and interventions¹³. DMH interventions can overcome many barriers, such as inhibiting help-seeking, accessibility in rural contexts, and reducing the burden on service providers. Drop-out subjects and non-completions are commonly reported in the literature, and adherence to digital health programs is also low in adolescents^{14,15}.

According to the complexity of these issues, different factors negatively impact the engagement and interaction with online programs, including lack of time, access and technical issues, no perceived need for help, program relevance, inappropriate content or repetitiveness, doubt regarding program effectiveness, preferences for face-to-face help, concerns about privacy and anonymity, or perceiving the program to be boring or activities laborious, a poorly

designed or delivered product^{16,17}. Among the barriers to adherence to treatment, an important role is played by the severity of the disease and how adherence is operationalized in the various studies. An improvement could be providing personalized interventions according to the individual's severity of illness, allowing participants to select the order of module completion or the choice of session scheduling with customized reminders. Furthermore, designers could incorporate various activities into DMH programs, including multiple-choice quizzes and case-enhanced learning strategies that use educational stories to illustrate problem-solving¹⁵.

Gamification (e.g. use of avatars, challenges, prizes, scores, etc.) and the use of Serious Games, is based on the e-learning approach. Several studies demonstrate that digitalized CBT programs, which use the paradigm exposed above, acquire a greater attractive, engaging and effective potential than those that do not use them. Gamification-based DMH interventions show their usefulness, for example in ADHD, autism spectrum disorders, eating disorders, post-traumatic stress, impulse control disorders, depression, schizophrenia, dementia and even in healthy aging¹⁸. Although there is much evidence on the effectiveness of serious games, to date there are many improvements to be made to understand how to enhance the compliance of these treatments.

In this innovative scenario of DMH, we investigate the serious game SPARX (Smart, Positive, Active, Realistic, X factor), based on Cognitive Behavioral Therapy, CBT practices¹⁹, one of the most used active RCT interventions²⁰. This intervention is included in the Digital CBT for mild depression for young people aged 12 to 18 by the National Institute of Health and Care Excellence (NICE)²¹. There are different versions of SPARX, although each version is articulated in seven modules (30-40 min each), including 1) Psychoeducation about depression and an introduction to the cognitive behavioral therapy model; 2) Activity scheduling and behavioral activation; 3) Dealing with strong emotions and interpersonal skills (assertiveness, listening, and negotiation); 4) Problem-solving and cognitive restructuring; 5) Cognitive restructuring; 6) Cognitive restructuring and interpersonal skills; 7) Recap of all skills, mindfulness (tolerating distress) and relapse prevention (knowing when to ask for help). SPARX is based on a 3D fantasy world, where it is possible to choose and customize its avatar and to interact with a 'guide' who plays the role of therapist. The modules are articulated as game levels, and a maximum of two levels per week is suggested.

This narrative review aims to identify the existing literature on SPARX for depressed youth populations, their experience of the treatment, and their satisfaction. Considering the role of therapists, the review also intended to clarify their role when involved in

the study design. Special attention was reserved to identify elements influencing the SPARX treatment's completion rate.

Methods

RESEARCH QUESTIONS

Three main research questions (RQ) were addressed:

1. Who were the young, depressed people who used SPARX and what was their experience with the treatment?
2. Were the users satisfied with the SPARX treatment? Did the level of satisfaction for perceived SPARX utilization by young people impact completion rates?
3. What was the role of professionals (researcher, counselor, teacher) in the SPARX studies? Did their support in SPARX execution influence the completion rates?

STUDY DESIGN

Three reviewers (RR, SM, SDV) searched PubMed, SCOPUS, and Web of Science databases using the search terms reported in figure 1. Researchers explored the term 'SPARX' and then narrowed the searches to depressive symptoms with the term 'depression' and the age group of interest, 'young adults'. From the search carried out for the term 'SPARX', 441 results emerged; 106 studies were found from the terms 'SPARX and Depression'; 10 scientific works were found with the terms 'SPARX and Young Adult', for a total of 557 scientific studies. Among these, 40 works were duplicated in the various searches, for a total of 517 studies that were analyzed. Among the exclusion criteria we identified the studies in which 'SPARX' represents a mobile APP on learning rural and agricultural concepts; The SPARX Trial which refers to a multicenter, randomized, controlled, single-blinded, study designed to test the feasibility of using high-intensity exercise to modify symptoms of Par-

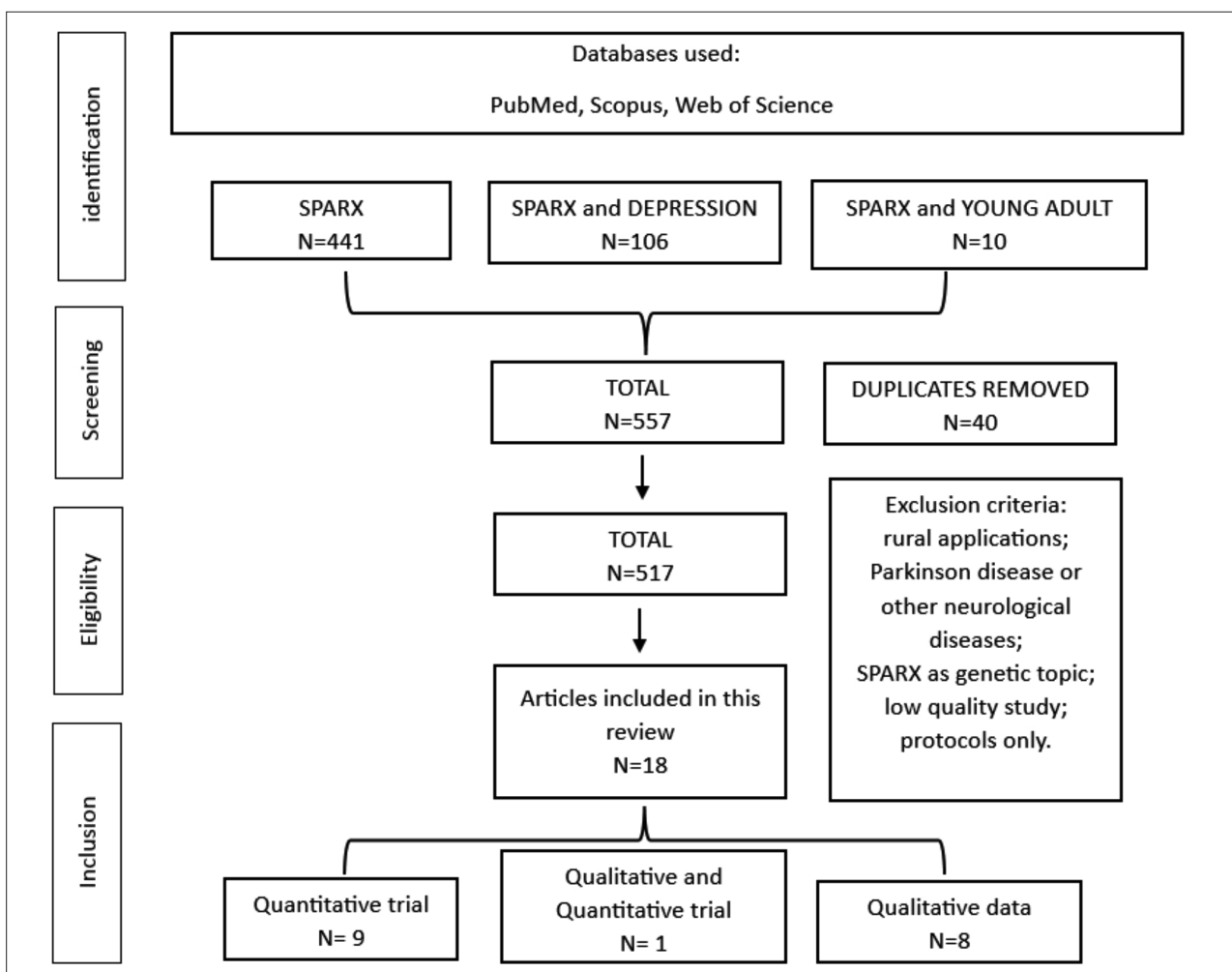


Figure 1. The PRISMA flow chart for study search and selection process.

kinson Disease; all those scientific works that dealt with the SPARC protein involved in inflammatory processes were excluded; SPARX works of low quality and in which only the protocol without results was reported were excluded.

Results

After evaluating the search terms 'SPARX', 'SPARX AND Depression', and 'SPARX AND Young Adult', the searches yielded 557 articles across the databases, analyzing the records by title and abstract. Exclusion criteria were applied, and 18 studies were recruited from 2012-2023. Among these studies, nine presented quantitative data, eight qualitative data, and one combined quantitative and qualitative data included in our work.

WHO WERE THE YOUNG, DEPRESSED PEOPLE WHO USED SPARX AND WHAT WAS THEIR EXPERIENCE WITH THE TREATMENT?

Characteristics of Quantitative and Qualitative Studies using SPARX

Table 1 (Supplementary material available in the online version of the paper) summarizes the characteristics of the included quantitative studies.

Six studies were conducted in New Zealand²²⁻²⁷, one in The Netherlands²⁴, one in Australia²⁸, one in Ireland²⁹, and one in Canada³⁰. All studies included adolescents in the age range of 12-19.

Out of ten quantitative studies, six are RCT studies^{22,23,28-31}, two are real-world studies^{26,27}, one study is a cohort study²⁵, and one is an observational study²⁴.

Regarding the features of the sample in these studies, one study recruited a clinical population affected by depressive symptoms who asked for help from health services²³; one study was conducted in a hospital youth inpatient unit²⁴; two studies evaluated students with depressive symptoms in a school prevention context^{28,31} or isolated communities³⁰; two studies in 'alternative school settings'^{22,29}. Two studies were conducted in the transgender or intersex adolescent population^{26,27} based on a Rainbow SPARX version developed for adolescents with depressive symptoms who are also sexually attracted by the same sex, both sexes, or who were questioning their sexuality (i.e., sexual minority youth)³². One study included a population of adolescent male offenders due to crime²⁵.

The samples included in the studies show a wide heterogeneity. From a clinical point of view, the severity of psychopathology ranges from acute psychosis²⁴ to depression²³ and to prevention of depression risk²⁸. The considered studies privilege culturally specific, community-led prevention programs with limited access to mental health resources, as for Maori²²

and Inuit young suffering people³⁰, gender minorities^{26,27} and 'special' population, as alternative school settings students^{22,29} and young offenders²⁵.

According to intervention treatment, five studies administered SPARX without external psychological supports^{24,26,27,30,31}; one study included school counselors' support in recruiting young users²³, and in two studies researchers gave their support and supervision to subjects included from alternative education settings^{22,29}. One study administered SPARX supported by teachers²⁸; one evaluated the impact of SPARX-R 1.0 and the compulsory rehabilitation program MYND supported by social workers²⁵.

Of the nine qualitative studies included in the present review and described in table 2 (available online), four studies carried out focus groups on a population of adolescents not belonging to 'special populations'^{18,33-35}, two studies carried out focus groups including LGBTQ+ adolescents^{36,37}. Two studies carried out focus groups and semi-structured interviews considering clinicians' opinions (counselors, clinical psychologists, nurses, etc.)^{18,38}.

Only one article conducted focus groups evaluating the point of view of family members³⁹, while two studies reported focus groups on communities with limited access to mental health resources (Maori)^{39,40}. Regarding the mean topic discussed in the different focus groups, two studies considered the issues related to the satisfaction and usefulness of SPARX^{33,35,40}, and two focus groups evaluated SPARX satisfaction with sexual minority issues^{36,37}. Two focus groups with clinicians included patient satisfaction and technical, structural, and monitoring implementations of SPARX^{18,38}. Family members participated in a focus group investigating their opinions on SPARX's contents and cultural style³⁹. Fleming et al.³⁴ conceptualized their focus group on the perceived usefulness of SPARX in preventive terms of depression (e.g., anger, stress, etc.).

WERE THE USERS SATISFIED WITH THE SPARX TREATMENT? DID THE LEVEL OF SATISFACTION FOR PERCEIVED SPARX UTILIZATION BY YOUNG PEOPLE IMPACT COMPLETION RATES?

Only five studies evaluated the level of SPARX satisfaction of participants through the administration of a short self-report questionnaire^{17,23,24,29,31}, comparing them with levels of completion rates levels (tables 3 and 4).

Concerning the level of satisfaction users express, what emerges from these studies is unclear.

In Merry et al.²³, SPARX participants expressed high satisfaction levels, although statistically significantly lower than youth receiving TAU (face-to-face counseling). The good results of the study appeared to be attributed to school counseling services and the recruitment of youth clinics in both study arms. The

professionals providing psychological interventions in the TAU arm were experienced counselors, establishing an excellent therapeutic alliance with young users.

The level of satisfaction monitored was also high in the inpatient ward study of Bobier et al.²⁴, although only 10% completed the SPARX program. One patient stated that she preferred individual talking therapy to computer treatment, while another said that SPARX made her feel worse.

In Poppelaars et al.³¹, although the two programs (SPARX and OVK) generated the same satisfaction rate (not very high), OVK was perceived as more attractive and more helpful in daily life, despite the completion rates. These data probably relate to the fact that no cultural adaptations were made for Dutch adolescents in SPARX.

Even the study by Kuosmanen et al.²⁹ showed a low level of satisfaction expressed by the SPARX-R group; only 30% of the sample completed virtual therapy. Staff members reported that young users felt more comfortable when the researcher was present, suggesting the need for professional mental health support to monitor student reactions and provide prompt support.

The SPARX-R version, providing practical skills for young people when depressed, down, angry, or stressed, received a modest satisfaction rating. More than half of the participants considered the program helpful for a young person struggling. However, only a third indicated they would recommend the program to a friend. A minority found the program uncomfortable, and a quarter stated that they were concerned about privacy. No clear patterns emerged when comparing user satisfaction ratings and completion rates. Most participants evaluated most levels as easy to use, enjoyable, and valuable²⁹.

It remains unclear whether young, depressed people are satisfied with SPARX if we assume that satisfaction would impact completion. There may be a full completion both with high levels of satisfaction and with low levels of satisfaction, suggesting that other factors may be involved in the appreciation of the SPARX intervention. The study published by Merry et al.²³ is the only one that presents high satisfaction levels with high completion rates. Instead, in Poppelaars et al.³¹, low levels of satisfaction present high completion rates, probably related to the fact the participants were offered a modest financial reward to participate in the post-test and follow-ups. In Bobier et al.²⁴, satisfaction levels were high. Still, completion rates were low because the population was recruited in a hospital inpatient unit, and the subjects presented different clinical pictures. The 'special' sample of students, not depressed but at risk of depression and leaving school early and attending an alternative education (AE) program, reported low levels of SPARX satisfaction and completion rates²⁹.

This finding could be justified by the difficulty in recognizing the real challenges of these young, troubled people.

WHAT WAS THE ROLE OF PROFESSIONALS (RESEARCHER, COUNSELOR, TEACHER) IN THE SPARX STUDIES? DID THEIR SUPPORT IN SPARX EXECUTION INFLUENCE THE COMPLETION RATES?

Five quantitative studies considered the role of the professionals within SPARX in supporting the intervention^{22,23,25,28,29} and six qualitative studies dealt the topic 'the importance of the therapist' within the various focus groups^{17,32,35,38,39,41} (table 3, available online).

In two studies, the support was provided by the same researchers^{22,29}, in one study by teachers²⁸, in one study by a school counselor²³. In one study, the researchers involved a social worker²⁵.

Merry et al.²³ showed how the role of counselors was helpful in recruiting subjects who could benefit from SPARX. The school counselors knew teenagers and suggested this treatment based on the more appropriate clinical indications. They could facilitate access to treatment for young people who may be reluctant to have more conventional therapy, showing how such a role of a counselor in recruitment leads to high completion rates and satisfaction (tables 3 and 4, available online).

The therapist involved in the Fleming et al. study²² was a Ph.D. candidate with experience as a clinician in adolescent health and mental health services, weekly visiting or telephoning the students in their classroom. He addressed any safety concerns or problems that may have arisen or supported students using the program. The fact that the intervention was offered during class time may have contributed to the high completion rates in SPARX (69%).

The Australian study by Perry et al.²⁸ does not include health professionals. Indeed, the SPARX-R intervention was completed over 5 to 7 weeks in class under teacher supervision, reporting a satisfactory completion rate. The Authors underlined the success of what could be defined as the first step in a stepped-care approach to mental health interventions, whereby young people within the school setting are provided with access to a universal, skills-oriented intervention, with those who require additional support being stepped up to a more intensive one.

The Irish study by Kuosmanen et al.²⁹ included both researchers at the program's start and a staff member who moderated the program. The researcher visited centers and addressed technical issues. The staff members were provided with a Program Manual and Study Instructions with detailed information on the day-to-day rollout of the study and the completion of the online assessment questionnaires. Also, the staff delivering the program was given a list of each student's SPARX login details in case they forgot them.

The protocol of Fleming et al.²⁵ was more articulated than that of other considered studies since SPARX-R was an add-on component. The professionals involved were social workers working at a compulsory day-based rehabilitation program for offenders (Mentoring Youth New Directions; MYND) for the study period, all of whom participated in the study. Each participant worked with their social worker to determine specific activities and goals.

Both Kuosmanen et al.²⁹ and Fleming et al.²⁵ reported low completion rates (table 4, available online). The samples considered in their study concerned 'troubled teens' exhibiting high levels of mental distress and legal/social-economics difficulties that presumably needed more support from a professional in a face-to-face mode or from online peer support.

As regards the six qualitative works that dealt with the 'therapist' topic within the various focus groups, it was highlighted that the majority of them considered the presence of the clinical therapist crucial both in the recruitment and in the monitoring of the SPARX treatment, not only to increase satisfaction and completion rates, but also to improve the therapeutic alliance (table 3, available online).

In particular, in the focus groups including both clinicians and adolescents, it emerged that the presence of a clinician is relevant both in the face-to-face mode¹⁷ and through online active monitoring of the progress of the SPARX treatment³⁸.

In two focus groups conducted on LGBT and non-LGBT adolescents, enrollment in the program³² and the support for dealing with emotional problems and talking about emotions³⁵ were effectively promoted by the figure of a clinical counselor.

Instead, a therapist's support did not seem necessary to learn the skills of the SPARKS treatment in the study involving Maori parents/caregivers and adolescents³⁹. Moreover, the presence of the therapist seemed to generate embarrassment for young people and create resistance to treatment⁴¹.

Discussion

The authors investigated the population who used SPARX, their experience, and their perceived satisfaction with this online treatment as a serious game for depression. They also identified which type of professionals were involved in the SPARX treatment and whether their support could impact satisfaction levels and compliance rates.

The population that uses SPARX is heterogeneous, and there are only a few studies conducted on the use of this serious game on users who require help for depressive symptoms. Most studies have been conducted on specific populations with limited access to mental health resources, fully reflecting the aims of

digital mental health and considering the use of technology as a fundamental resource to overcome socio-economic and cultural limits to access to care. Special populations, such as offenders or difficult young adolescents, underlined the need to adapt SPARX, as other serious games, to different young languages and backgrounds. These data highlight the importance of tailored interventions that can address the complexity of the depressive experience and the adolescents' various socio-economic and cultural settings. Our results are in line with other studies that highlighted how user's characteristics, such as their age, development, gender identity, and the nature and severity of their difficulties, must be taken into consideration to understand better who to provide this intervention^{34,42}. Young users who decide to use a serious game like SPARX will have individual preferences regarding the content and design of technologies and their overall approach (e.g., social media, chatbot). After all, some might prefer to engage only with face-to-face therapy or self-help booklets. Therefore, it seems crucial that young people have a choice, where possible, regarding how they access support⁴³.

The results are ambiguous regarding the satisfaction levels of young people who use SPARX. This narrative review revealed the highest satisfaction levels in young help-seekers to mental health resources. However, satisfaction with the use of SPARX does not appear to be high in young adults with subclinical depression or at risk of depression onset but not yet showing severe emotional suffering. Moreover, these data linked to satisfaction levels do not impact completion rates, suggesting that many other aspects may do it. These findings can be justified by the difficulty of adolescents identifying depression symptoms, often having abnormal experiences referred to as transdiagnostic psychopathological patterns.

Narrative structure^{33,35}, a Guide character - virtual therapist^{33,39} and challenges - CBT homework tasks^{32,17} seemed to contribute in satisfaction and completion rates also. A relevant role in the completion rates is also played by customization of the game in terms of users' culture - symbols, language, norms, values, and artifacts^{30,39,40}, and user gender identity, reflected through the avatar gender^{26,27,36}. Recent literature supports our data by suggesting that the variability in satisfaction outcomes may be related to differences in the virtual game elements and the suitability of specific gamification components for customers with different demographic characteristics. Indeed, the correlation between satisfaction and completion rate should consider the potential benefits and costs of personalization versus standardization of gamification⁴⁴.

Although SPARX is a serious game not driven by face-to-face support, different professional figures were involved in the selected studies to support SPARX users. Researchers, school counselors, men-

tal health clinicians, teachers, and social workers were among these. If the role of professional support in addition to the treatment was unclear in adolescents and young adults⁴⁵, our findings showed that the presence of the school counselor was beneficial in impacting satisfaction and completion rates by recruiting and selecting the users who could benefit most from it. Moreover, it has been proven that monitored settings, such as primary care settings, may increase enrollment in online youth programs⁴⁶.

The presence of a researcher with clinical experience in mental health, who provides emotional support supplementary to SPARX in face-to-face or online/telephone mode, seemed to impact the percentage of completion rates. Consistently, whereas teachers and researchers gave support without any clinical mental health experience, satisfaction levels remained low along with those of completion rates, underlining the importance of integrating mental health professionals into SPARX. A recent review confirms these data, highlighting how the assistance provided by professionals with clinical training and experience could improve satisfaction levels and completion rates in supporting the utilization of serious games⁴².

Furthermore, these data found in the present study conducted on SPARX are in line with the data also present in the literature on other serious games; in fact in a recent meta-analysis⁴⁷ it emerged that the most used serious games for the treatment of depression (including SPARX, Wii Fit, Kinect Sport, MindLight, etc.) present a high number of dropouts and missing data in the follow-up phase and it is important to collect as much data as possible to enhance the use of serious games in clinical practice. It would be interesting to delve deeper and compare in future studies how clinician support and the administration practice could impact on completion rates in different serious games treatments.

Conclusions

To the best of our knowledge, our narrative review, including quantitative and qualitative studies, is the first to analyze and discuss the professional's role in supporting SPARX, an issue not considered in previous reviews. Following the growing increase in depression among young people, it is necessary to ask how services and therapeutic programs can facilitate access to this population and help them maintain adherence to treatments. DMH and gamification seem to be one way to overcome barriers (eg stigma, costs, accessibility in rural contexts) that prevent young people from asking for help. In particular, gamification could be a promising paradigm for building digital mental health programs that promote stimulating engagement.

More accurate answers could be given to our research questions if further studies will better define

the characteristics of the young depressed users who can benefit most from these digital interventions, mainly addressed to primary care contexts, in a sort of 'precision serious game' preventive treatment⁴⁸.

We foresee that future directions should also include optimizing user choice, as typical for Internet applications, and improving integration between digital tools and clinical services.

Conflict of interests: the authors have no conflict of interests to declare.

References

1. World Health Organization. World mental health report: transforming mental health for all. Geneva: World Health Organization, 2022.
2. Kauhanen L, Wan Mohd Yunus WMA, Lempinen L, et al. A systematic review of the mental health changes of children and young people before and during the COVID-19 pandemic. *Eur Child Adolesc Psychiatry* 2023; 32: 995-1013.
3. Huang HC, Ougrin D. Impact of the COVID-19 pandemic on child and adolescent mental health services. *BJPsych Open* 2021; 7: e145.
4. Bevilacqua L, Fox-Smith L, Lewins A, et al. Impact of COVID-19 on the mental health of children and young people: an umbrella review. *J Epidemiol Community Health* 2023; 77: 704-9.
5. Gearing RE, Schwalbe CS, Short KD. Adolescent adherence to psychosocial treatment: mental health clinicians' perspectives on barriers and promoters. *Psychother Res* 2012; 22: 317-26.
6. Timlin U, Hakko H, Heino R, Kyngäs H. Factors that affect adolescent adherence to mental health and psychiatric treatment: a systematic integrative review of the literature. *Scand J Child Adolesc Psychiatr Psychol* 2014; 3: 99-107.
7. Stafford AM, Garbuz T, Etter DJ, et al. The natural course of adolescent depression treatment in the primary care setting. *J Pediatr Health Care* 2020; 34: 38-46.
8. Hage A, Weymann L, Bliznak L, Marker V, Mechler K, Dittmann RW. Non-adherence to psychotropic medication among adolescents: a systematic review of the literature. *Z Kinder Jugendpsychiatr Psychother* 2018; 46: 69-78.
9. Laranjeira C, Carvalho D, Valentim O, et al. Therapeutic adherence of people with mental disorders: an evolutionary concept analysis. *Int J Environ Res Public Health* 2023; 20: 3869.
10. Balcombe L, De Leo D. Evaluation of the use of digital mental health platforms and interventions: scoping review. *Int J Environ Res Public Health*. 2022; 20: 362.
11. Gude J, Subhedar RV, Zhang MH, et al. Emerging needs and viability of telepsychiatry during and post COVID-19 era: a literature review. *Cureus* 2021; 13: e16974.
12. Pretorius C, Chambers D, Coyle D. Young people's online help-seeking and mental health difficulties: systematic narrative review. *J Med Internet Res* 2019; 21: e13873.
13. Sverdllov O, van Dam J, Hannesdottir K, Thornton-Wells T. Digital therapeutics: an integral component of digital innovation in drug development. *Clin Pharmacol Ther* 2018; 104: 72-80.
14. Grist R, Croker A, Denne M, Stallard P. Technology delivered interventions for depression and anxiety in children and adolescents: a systematic review and meta-analysis. *Clin Child Fam Psychol Rev* 2019; 22: 147-71.
15. Achilles MR, Anderson M, Li SH, Subotic-Kerry M, Parker B, O'Dea B. Adherence to e-mental health among youth:

- considerations for intervention development and research design. *Digit Health* 2020; 6: 2055207620926064.
16. Lillevoll KR, Vangberg HC, Griffiths KM, Waterloo K, Eisemann MR. Uptake and adherence of a self-directed internet-based mental health intervention with tailored e-mail reminders in senior high schools in Norway. *BMC Psychiatry* 2014; 14: 14.
 17. Kuosmanen T, Fleming TM, Barry MM. The implementation of SPARX-R computerized mental health program in alternative education: exploring the factors contributing to engagement and dropout. *Child Youth Serv Rev* 2018; 84: 176-84.
 18. Vajawat B, Varshney P, Banerjee D. Digital gaming interventions in psychiatry: evidence, applications and challenges. *Psychiatry Res* 2021; 295: 113585.
 19. Fleming T, Lucassen M, Stasiak K, Sutcliffe K, Merry S. Technology matters: SPARX - computerised cognitive behavioural therapy for adolescent depression in a game format. *Child Adolesc Ment Health* 2021; 26: 92-4.
 20. Townsend C, Humpston C, Rogers J, Goodyear V, Lavis A, Michail M. The effectiveness of gaming interventions for depression and anxiety in young people: systematic review and meta-analysis. *BJPsych Open* 2022; 8: e25.
 21. National Institute for Health and Care Excellence. NICE Guideline [NG134]. Depression in children and young people: identification and management. 2019.
 22. Fleming T, Dixon R, Frampton C, Merry S. A pragmatic randomized controlled trial of computerized CBT (SPARX) for symptoms of depression among adolescents excluded from mainstream education. *Behav Cogn Psychother* 2012; 40: 529-41.
 23. Merry SN, Stasiak K, Shepherd M, Frampton C, Fleming T, Lucassen MF. The effectiveness of SPARX, a computerised self help intervention for adolescents seeking help for depression: randomised controlled non-inferiority trial. *BMJ* 2012; 344: e2598.
 24. Bobier C, Stasiak K, Mountford H, Merry S, Moor S. When 'e' therapy enters the hospital: examination of the feasibility and acceptability of SPARX (a cCBT programme) in an adolescent inpatient unit. *Adv Ment Health* 2014; 11: 286-92.
 25. Fleming TM, Gillham B, Bavin LM, et al. SPARX-R computerized therapy among adolescents in youth offenders' program: step-wise cohort study. *Internet Interv* 2019; 18: 100287.
 26. Lucassen MF, Stasiak K, Fleming T, et al. Computerized cognitive behavioural therapy for gender minority adolescents: analysis of the real-world implementation of SPARX in New Zealand. *Aust N Z J Psychiatry* 2021; 55: 874-82.
 27. Lucassen MFG, Perry Y, Frampton C, et al. Intersex adolescents seeking help for their depression: the case study of SPARX in New Zealand. *Australas Psychiatry* 2021; 29: 450-3.
 28. Perry Y, Werner-Seidler A, Cascar A, et al. Preventing depression in final year secondary students: school-based randomized controlled trial. *J Med Internet Res* 2017; 19: e369.
 29. Kuosmanen T, Fleming TM, Newell J, Barry MM. A pilot evaluation of the SPARX-R gaming intervention for preventing depression and improving wellbeing among adolescents in alternative education. *Internet Interv* 2017; 8: 40-7.
 30. Bohr Y, Litwin L, Hankey JR, et al. Evaluating the utility of a psychoeducational serious game (SPARX) in protecting Inuit youth from depression: pilot randomized controlled trial. *JMIR Serious Games* 2023; 11: e38493.
 31. Poppelaars M, Tak YR, Lichtwarck-Aschoff A, et al. A randomized controlled trial comparing two cognitive-behavioral programs for adolescent girls with subclinical depression: a school-based program (Op Volle Kracht) and a computerized program (SPARX). *Behav Res Ther* 2016; 80: 33-42.
 32. Lucassen MFG, Merry SN, Hatcher S, Frampton CMA. Rainbow SPARX: a novel approach to addressing depression in sexual minority youth. *Cogn Behav Pract* 2015; 22: 203-16.
 33. Cheek C, Bridgman H, Fleming T, et al. Views of young people in rural Australia on SPARX, a fantasy world developed for New Zealand youth with depression. *JMIR Serious Games* 2014; 2: e3.
 34. Fleming T, Merry S, Stasiak K, et al. The importance of user segmentation for designing digital therapy for adolescent mental health: findings from scoping processes. *JMIR Ment Health* 2019; 6: e12656.
 35. Fleming T, Lucassen M, Stasiak K, Shepherd M, Merry S. The impact and utility of computerised therapy for educationally alienated teenagers: the views of adolescents who participated in an alternative education-based trial. *Clinical Psychologist* 2020; 20: 94-102.
 36. Lucassen MFG, Hatcher S, Stasiak K, Fleming T, Shepherd M, Merry SN. The views of lesbian, gay and bisexual youth regarding computerised self-help for depression: an exploratory study. *Adv Ment Health* 2014; 12: 22-33.
 37. Lucassen MF, Hatcher S, Fleming TM, Stasiak K, Shepherd MJ, Merry SN. A qualitative study of sexual minority young people's experiences of computerised therapy for depression. *Australas Psychiatry* 2015; 23: 268-73.
 38. Sundram F, Hawken SJ, Stasiak K, et al. Tips and traps: lessons from codesigning a clinician e-monitoring tool for computerized cognitive behavioral therapy. *JMIR Ment Health* 2017; 4: e3.
 39. Shepherd M, Fleming T, Lucassen M, Stasiak K, Lambie I, Merry SN. The design and relevance of a computerized gamified depression therapy program for indigenous Maori adolescents. *JMIR Serious Games* 2015; 3: e1.
 40. Shepherd M, Merry S, Lambie I, Thompson A. Indigenous adolescents' perception of an eMental Health Program (SPARX): exploratory qualitative assessment. *JMIR Serious Games* 2018; 6: e13.
 41. Fleming TM, Stasiak K, Moselen E, et al. Revising computerized therapy for wider appeal among adolescents: youth perspectives on a revised version of SPARX. *Front Psychiatry* 2019; 10: 802.
 42. Bevan Jones R, Hussain F, Agha SS, et al. Digital technologies to support adolescents with depression and anxiety: review. *BJPsych Adv* 2023; 29: 239-53.
 43. Cheng VWS. Recommendations for implementing gamification for mental health and wellbeing. *Front Psychol* 2020; 11: 586379.
 44. Cheng C, Ebrahimi OV. Gamification: a novel approach to mental health promotion. *Curr Psychiatry Rep* 2023; 25: 577-86.
 45. Hollis C, Falconer CJ, Martin JL, et al. Annual research review: digital health interventions for children and young people with mental health problems - A systematic and meta-review. *J Child Psychol Psychiatry* 2017; 58: 474-503.
 46. Sieverink F, Kelders SM, van Gemert-Pijnen JE. Clarifying the concept of adherence to eHealth technology: systematic review on when usage becomes adherence. *J Med Internet Res* 2017; 19: e402.
 47. Abd-Alrazaq A, Al-Jafar E, Alajlani M, et al. the effectiveness of serious games for alleviating depression: systematic review and meta-analysis. *JMIR Serious Games* 2022; 10: e32331.
 48. Ashley EA. Towards precision medicine. *Nat Rev Genet* 2016; 17: 507-22.

Corresponding author:
Rita Roncone
E-mail: rita.roncone@univaq.it

Table 1. Characteristics of the quantitative studies included in the current narrative review.

Authors (location)	Total, n	Experimental design	Population target and setting	Primary outcome (measure)	Intervention description	Intervention group, n	Control group	Control group, n	Main findings
Fleming et al. ²² (New Zealand)	32	Pragmatic RCT	Adolescents (18 men, 14 women, aged 13-16 years) excluded or alienated from mainstream education with mild to moderate depressive symptoms. Māori youth (34%) <i>Setting:</i> alternative schooling programs for those excluded from mainstream education.	Depression (CDRS-R)	SPARX + Weekly tutor supervising by telephone	20	SPARX, after five weeks of waitlist control	12	Assessments were at baseline, five weeks, and ten weeks. There were significant differences between the cCBT and waitlist groups in CDRS-R with reduced depressive symptomatology. CDRS-R changes and remission remained significant, also at the 10-week follow-up. There were indications of the potential efficacy of SPARX in alternative schooling environments.
Merry et al. ²³ (New Zealand)	187	RCT Non-inferiority	Adolescents (63 men, 124 women, aged 12-19) help-seekers in 24 primary health sites for symptoms of mild-to-moderate depression. <i>Setting:</i> Primary healthcare sites (youth clinics, general practices, and school-based counseling services).	Depression (CDRS-R)	SPARX + In the last module Recap of all skills; Mindfulness and Relapse prevention + Counsellor supporter	94	TAU Trained counsellors or clinical psychologists provide face-to-face counselling.	93	The evaluations were performed at the beginning of the study, after the intervention, and at three months of follow-up. Per-protocol analysis showed a non-inferiority of SPARX compared to TAU. The post-intervention analysis showed a significant reduction rate in the SPARX arms.
Bobier et al. ²⁴ (New Zealand)	20	Observational study	Adolescents (12 men, 8 women, mean age 16.5 years). <i>Diagnosis:</i> Bipolar mood disorders (n=5) Unipolar mood disorder (n=10) Anxiety disorders (n=3) Psychotic disorder (n=1)	Depression (RADS-2; MIFQ)	SPARX	20	-	-	Assessment at baseline and planned after intervention. Most patients offered therapy agreed to trial SPARX, with 60% continuing beyond the first module and 10% (2 subjects) completing the program before discharge.

(Continued)

(Continued) - Table 1.

Authors (location)	Total, n	Experimental design	Population target and setting	Primary outcome (measure)	Intervention description	Intervention group, n	Control group	Control group, n	Main findings
Poppelaars et al. ³¹ (The Netherlands)	208	RCT	Parent-child relationship problems (n=1). <i>Setting:</i> Hospital Youth Inpatient Unit The length of admission for participants varied greatly (11-145 days), with patients staying on average 47 days (SD=30 days).	Depression (RAD5-2)	SPARX	51	4 groups: 1. School-based Cognitive Behavioral Therapy (CBT). 2. Prevention program 'Op Volle Kracht', OVK (n=50). 3. SPARX (n=51). 4. OVK and SPARX combined (n=56). 5. A digitalized monitoring control condition (n=51).	157	Results suggest that 1) in an inpatient unit, it is feasible to offer e-therapy, and adolescent patients were generally interested in trying it. 2) E-therapy in an inpatient unit may have limited therapeutic power Depressive symptoms were assessed at the beginning, weekly, during, and immediately after the interventions ended, with follow-up evaluations at 3, 6, and 12 months. Depressive symptoms decreased in all conditions.
Kuosmanen et al. ²⁹ (Ireland)	66	RCT	High school students (68 men, 78 women, aged 15-20) leaving school early and attending an alternative education (AE) program at risk of developing depression. <i>Setting:</i> SPARX-R was conducted during scheduled class time. At each weekly class, the students completed the one module of the program.	Anxiety Depression (GAD-7; SMFQ)	SPARX-R + Researcher support	30	No intervention control group	36	Assessments were at baseline and post-intervention. No differences were detected in depressive symptom reduction, but there was a significant improvement in emotion regulation strategies in the SPARX-R group compared to controls.

(Continued)

(Continued) - Table 1.

Authors (location)	Total, n	Experimental design	Population target and setting	Primary outcome (measure)	Intervention description	Intervention group, n	Control group	Control group, n	Main findings
Perry et al. ²⁸ (Australia)	540	RCT	Final year secondary students (mean age 16.7 years). <i>Setting:</i> SPARX-R was delivered to students on desktop computers via the Internet in school classrooms to prevent depression before facing a significant stressor, final secondary school exams.	Depression (MDI)	SPARX-R + supplemented with a paper notebook for students to review key messages from each module and record personal comments + Teacher support	242	<i>LifeSTYLE online program:</i> each of which took 20 to 30 minutes to complete. The program covers the following topics: independence, participation in your community, work skills, safety and hygiene, healthy skin, sustainable eating, and maintaining a healthy home environment.	298	Assessments were at baseline, after intervention, and at 6-month and 18-month follow-ups. Compared to controls, participants in the SPARX-R condition showed significantly reduced depression symptoms at post-intervention and 6-month post-baseline but not at 18-month post-baseline.
Fleming et al. ²⁵ (New Zealand)	40	Step-wise cohort study	Male adolescents (aged 14-17) referred for offending to a community rehabilitation service. <i>Setting:</i> MYND office, home, or other private space.	Depression (RADS-2; CDRS-R)	Mentoring Youth New Directions, MYND* + SPARX-R 1.0 (revised version of SPARX) + Social Workers support	19	MYND is based on one-to-one mentoring, goal setting, problem-solving, task-centered social work, and youth development activities completed with a specialist social worker at the participant's home or community, 6-30 hours a week. *The MYND program is a compulsory community rehabilitation program for males aged 14-17 years	21	Assessments were completed within the first two weeks of commencing the MYND program and then at 10 and 20 weeks after commencement. SPARX-R cCBT was not engaging for these participants; highlighting that it cannot be assumed that cCBT has proven acceptable and effective in some settings.

(Continued)

<i>(Continued)</i> - Table 1.									
Authors (location)	Total, n	Experimental design	Population target and setting	Primary outcome (measure)	Intervention description	Intervention group, n	Control group	Control group, n	Main findings
Lucassen et al. ²⁶ (New Zealand)	9079	Large open 'real world' trial (Quantitative analysis of 5 years of usage data from the national delivery of SPARX in New Zealand).	Male, female, and transgender adolescents (2.3%) (aged 12-19) with different degrees of depressive symptoms (mild to severe). <i>Setting:</i> Free online self-help intervention program via personal computer.	Depression (PHQ-A)	SPARX in transgender adolescents with depression	207	SPARX whom statutory authorities have referred for offending; it is an alternative for young people who would otherwise be given custodial sentences, frequently for convictions related to violence.	8872	SPARX users were asked to complete the PHQ-A at the start of Module 1 (i.e., baseline), at Module 4 (i.e., a mid-point assessment) and in Module 7 (i.e., the post-SPARX measure). Most transgender registrants (69.0%) who completed PHQ-A at baseline were categorized as having high mental health needs, significantly more than male and female registrants. Improvement of depressive symptoms only in men and women, not in transgenders
Lucassen et al. ²⁷ (New Zealand)	8922	Large open 'real world' trial (secondary analysis of SPARX usage data over 5 years).	Male, female, and intersex (0.6%) adolescents with different degrees of depressive symptoms (mild to severe). <i>Setting:</i> Free online self-help intervention program via personal computer.	Depression (PHQ-A)	SPARX in intersex adolescents with depression	50	SPARX	8872	78.3% of intersex users had high levels of depression and/or self-harm and suicidal ideation. Unable to meaningfully investigate any reductions in depressive symptoms over time in the intersex population

(Continued)

(Continued) - Table 1.

Authors (location)	Total, n	Experimental design	Population target and setting	Primary outcome (measure)	Intervention description	Intervention group, n	Control group	Control group, n	Main findings
Bohr et al. ³⁰ (Canada, Inuit population)	24	Pilot study Modified RCT	Inuit adolescents, aged 13-18, with limited access to specialized services. <i>Setting:</i> Youth played SPARX on the laptops in either the community facilitator's office or in an office in their school.	Depression (CESD-R)	SPARX	20	Waitlist control	19	Assessments were at baseline and post-intervention. The participating youth felt less hopeless and engaged in less self-blame, rumination, and catastrophizing following the SPARX intervention. However, the participants did not show a decrease in depressive symptoms or an increase in formal resilience indicators.

Table 2. Main characteristics of the included qualitative studies.

Authors (location)	Participants	Methods	Results
Lucassen et al. ³⁶ (New Zealand)	N=9 (LGB young people; 56% women, aged 16-27)	Exploratory study based on 3 focus groups on: 1. explore the challenges that youth of LGB face; 2. determine whether the identified challenges LGB youth face could and should be addressed in SPARX (and if so, investigate how a cCBT program could be successfully adapted for LGB youth); 3. help in the pre-testing design, characters, and scenarios of prototypes of a cCBT program (SPARX).	The prototypes of a 'generic' cCBT program did not address all the issues that youth with LGB face. It proved feasible to adapt a cCBT program to take this feedback into account (premises for the creation of Rainbow SPARX, [3]).
Cheek et al. ³³ (Australia)	N=16 (12 men and 4 women, aged 13-18, living in a small rural Australian town)	Focus groups and semi-structured interviews about evaluating SPARX (Personalization, Engagement, Stigma.)	Computerized therapy offered in ways that support privacy and choice can improve access to treatment for rural youth. Issues of engaging design and confidential access appeared to be more important.
Lucassen et al. ³⁷ (New Zealand)	N=25 (12 identified males and 13 females, with two participants' gender identity and sex assigned at birth differing, aged 13-19)	Interviews with LGBTQ+ youth who used a form of computerized therapy (Rainbow SPARX) for depression [3]. They discussed five main themes: 1. appealing aspects; 2. applying SPARX to real life; 3. things to improve; 4. aspects that did not appeal; 5. other themes.	Seventeen participants thought that computerized therapy helped them feel better or less depressed. The input of the users helps improve services. The study provides important in-depth feedback on Rainbow SPARX from the perspective of youth from sexual minorities.
Shepherd et al. ³⁹ (New Zealand)	N=26 (19 taitamarki, 7 parents, all Māori)	Seven focus groups and individual interviews with indigenous New Zealand young people (taitamarki) and their families to discover their opinions about SPARX (look and style of the game, the content, the cultural content).	The SPARX computerized therapy had good face validity for indigenous young people and their families. Indigenous families need to help them encourage and support their young people with depression when using cCBT. Learning a simple relaxation exercise (breathing/relaxation skill) was particularly beneficial.
Sundram et al. ³⁸ (New Zealand)	N=50 (Clinicians working in primary care: general practitioners (GPs), school guidance counselors, clinical psychologists, youth workers, and nurses) N=29 (Adolescents, aged 12-19)	Semi-structured focus groups included clinicians who worked in primary care and adolescents. They were aimed to provide feedback in 3 phases corresponding to the consultation, development, and post-implementation stages. Themes: <i>For clinicians:</i> Registration system to gain access to the e-monitoring section of SPARX; Electronic linking of adolescent user data to the referring clinician; Ability to personalize the e-monitor by the adolescent; Web-based dashboard to allow clinicians to track all the adolescent users who were prescribed SPARX; an algorithm to automatically generate alerts at specific and concerning levels of depression or self-harm; etc.)	The study revealed the complexity of implementing the tool in clinical practice of salience: privacy, parallel monitoring systems, integration with existing electronic medical record systems, customization of the e-monitor, and pre-agreed monitoring arrangements between clinicians and adolescents.

(Continued)

(Continued) - Table 2.

Authors (location)	Participants	Methods	Results
Kuosmanen et al. ¹⁷ (Ireland)	N=28 students (32.1% men, 67.9% women, mean age 17.32 years) N=6 staff member (From six of the nine centers)	The students and staff moderators completed a post-intervention questionnaire [4]. Student opinions were explored using 5-point Likert-style questions on five areas: 1) Engagement; 2) Ease of use; 3) Relevance; 4) Usefulness, and 5) Overall satisfaction. In addition, student views were explored through interviews about the look, content, and implementation. Clinicians' opinions were investigated by open-ended and Likert-type questions to explore five aspects: 1) Student engagement; 2) Usefulness; 3) Program implementation; 4) Overall satisfaction, and 5) Views on computerized delivery in general.	Most students considered SPARX-R easy to use and agreed that the program made sense. However, less than half of the participants liked the program's look. Only a third (32.2%) indicated they would recommend the program to a friend. Those categorized as at risk for depression rated the program higher in relevance and usefulness than those with no symptoms or clinical symptoms of depression. Staff expressed a need for increased flexibility in the delivery and complementing computerized programs with face-to-face activities to improve student engagement.
Shepherd et al. ⁴⁰ (New Zealand)	N=6 (n=1 man; n=5 women of the Māori population, aged 12-19)	Follow-up semi-structured interviews were conducted once users had completed work with the SPARX resource [5]. Five themes were investigated: 1) SPARX helpfulness to learn CBT skills; 2) Māori designs; 3) Characters in SPARX provided hope and helpful advice; 4) SPARX design was enjoyable and provided challenging factors; 5) SPARX Booklet helped in recording participants thoughts and feelings.	Adolescents reported that: 1. SPARX is useful for the acquisition of relaxation and cognitive restructuring skills. 2. Māori designs were appropriate and appreciated. 3. SPARX improved mood and increased levels of hope. 4. In some cases, SPARX was used by broader family members with beneficial effects (family health). 5. The booklet is a helpful resource.
Fleming et al. ⁴¹ (New Zealand)	N=79 (47 women and 32 men, aged 13-19)	Nine focus groups, structured discussions, and a brief questionnaire were conducted to test the revised version (SPARX-R). Although SPARX is explicitly presented as a treatment for depression, SPARX-R provides skills that could be useful to young people when they are depressed, down, angry, or stressed. Four themes were grouped: 1) accessibility of computerized therapy; 2) the appropriate use of the term "depression"; 3) the universality of playing SPARX; 4) the question of whether SPARX is a good tool to treat depression.	Participants considered both SPARX and SPARX-R useful and believed the program's stated purpose to be important. Although the adolescents felt that the 'less' clinical formulation of SPARX-R may appeal to a broader range of adolescents, they suggested that users should choose between the two versions of treatment, SPARX or SPARX-R.
Fleming et al. 2016 – online 2020 (New Zealand)	N=39 (17 men and 13 women, aged 13-16)	Semi-structured interviews and brief satisfaction questionnaires were completed post-cCBT [6] to assess both personal experience of using SPARX and if they would recommend SPARX to other young people.	Over 85% of participants reported that they would recommend SPARX to a friend. Adolescents in alternative education programs, including both those with and those without symptoms of possible depression, considered that SPARX: 1) Helped them, particularly with issues such as a sense of calmness and reducing anger and fighting. 2) Would be likely to increase young people's help-seeking from adults. 3) Should be offered to all young people in alternative education and similar programmes.

Table 3. Users' engagement, therapist's role, positive SPARX's opinion, limitations, suggestions for improvement, and satisfaction elements of the qualitative and quantitative included studies.

Authors (location)	Users engagement	Therapist's role	Positive opinions	Limitations/ disengagement	Suggestions for Improvement	Satisfaction assessment
Fleming et al. ²² (New Zealand)	Parent involvement in study recruitment.	Weekly tutor supervising by telephone.	-	-	-	-
Merry et al. ²³ (New Zealand)	Youth participation in game development.	Young people who are not improving in the SPARX group are encouraged to seek the help of their referring clinicians.	-	A few young people did not want to ask their parents for consent. A small number of adolescents did not like computers. Someone specifically wanted to talk to someone.	-	Satisfaction was monitored using a self-report questionnaire. 95.0% (n=76) of SPARX's participants and 98.6% (n=70) in the TAU group (p=0.371) believed that the type of support they received would appeal to other teenagers, and 80.5% (n=64) of SPARX's participants and 95.8% (n=68) in the TAU group (P=0.005) would recommend the treatment to their friends. In the SPARX group, 53.2% (n=43) would have liked the sessions to be the length they were, 44.3% (n=35) wanted the sessions to be longer, and 61.5% (n=49) reported that they completed all or most of the set challenges.
Bobier et al. ²⁴ (New Zealand)	-	-	-	-	1. Improved graphics and quicker action to make SPARX commercially available games 2. More options for avatar customization and design.	A brief-self report questionnaire monitored satisfaction. 93% (N=13) felt that SPARX would appeal to other young people and 79% (N=11) said they would recommend the program to their friends.
Lucassen et al. ³⁶ (New Zealand)	Collaboration between clinicians and youth in game development	Not addressed	Positive comments about the 'look and feel' of SPARX. 1. Positive comments about one's ability to be gender non-conformist; and, 2. Positive feedback about the broader concept of cCBT.	1. Female participants identified having only a male Guide character was an issue. 2. Language should be in keeping with the game setting. 3. Reading should be kept to a minimum and should not be too explicitly a 'depression game'. 4. Participants identified issues with gameplay, specifically that the mini-games are too easy.	The prototypes of a 'generic' cCBT program did not address all the issues that youth with LGB face. It proved feasible to adapt a cCBT program to take this feedback into account (premises for the creation of Rainbow SPARX.	-

(Continued)

(Continued) - Table 3.

Authors (location)	Users engagement	Therapist's role	Positive opinions	Limitations/ disengagement	Suggestions for Improvement	Satisfaction assessment
Cheek et al. ³³ (Australia)	Youths and family assessment and feedback	Not specifically addressed	<ol style="list-style-type: none"> 1. Narrative structure of the program. 2. The use of different characters and the personalization of an avatar. 3. "Socialization" with the Guide character. 4. Journaling diary. 5. Encourage feedback. 6. Engaging design and confidential access. 	<ol style="list-style-type: none"> 1. School setting was seen as a limit due to the fear of judgment and reprisal from peers. 2. The SPARX program might be less appealing to those who do not play computer games. 	Computerized therapy offered in ways that support privacy and choice can improve access to treatment for rural youth. Issues of engaging design and confidential access appeared to be more important.	-
Lucassen et al. ³² (New Zealand)	Collaboration between clinicians and youth in game development	Guidance counselors were identified as necessary in the rollout of the program.	<ol style="list-style-type: none"> 1. Game format. 2. Look and feel. 3. Features of 6 characters. 4. "Rainbow" content. 5. Completion of challenges (cognitive behavioral therapy homework tasks) and application of skills. 	<ol style="list-style-type: none"> 1. Mini-games or puzzles should be more challenging. 2. Less talking or dialogue and more game play. 3. Insufficient 'rainbow' content. 4. The terminology about sexuality should be improved. 	Seventeen participants thought that computerized therapy helped them feel better or less depressed. The input helps improve services. The study provides relevant, in-depth feedback on Rainbow SPARX from the perspective of sexual minority youth.	-
Shepherd et al. ³⁹ (New Zealand)	Youths, providers, and various Māori experts contributed to game design and development; youths included in co-design workshops.	cCBT programs without direct therapist input can teach skills.	<ol style="list-style-type: none"> 1. Cultural relevance was considered important for the engagement. 2. Guide character as a model for the participants. Māori designs. 	<p>SPARX needed more activities for Māori males, and the puzzles and challenges required were more difficult. Developers should increase the use of audio rather than text.</p>	The SPARX computerized therapy had good face validity for indigenous young people and their families. Indigenous families need to help them encourage and support their young people with depression when using cCBT. Learning a simple relaxation exercise (breathing/relaxation skill) was particularly beneficial.	

(Continued)

(Continued) - **Table 3.**

Authors (location)	Users engagement	Therapist's role	Positive opinions	Limitations/ disengagement	Suggestions for Improvement	Satisfaction assessment
Fleming et al. 2016 – online 2020 (New Zealand)	-	Guidance counselors are identified as important for telling about their feelings.	<ol style="list-style-type: none"> 1. Narrative structure. 2. Guide character (a virtual therapist). 3. Game format. 	Therapeutically limited ("If you have other problems the computer cannot solve, you need a counselor).	<p>Over 85% of participants reported that they would recommend SPARX to a friend.</p> <p>Adolescents in alternative education programs, including both those with and those without symptoms of possible depression, considered that SPARX cCBT:</p> <ol style="list-style-type: none"> 1. Helped them, particularly with calmness and reducing anger and fighting. 2. This would likely increase the need for help from young people and adults. 3. Should be offered to all young people in alternative education and similar programs. 	-
Poppelaars et al. ³¹ (The Netherlands)	-	Not addressed	-	<ol style="list-style-type: none"> 1. No cultural adjustments were made for Dutch adolescents. 2. SPARX is not comparable to commercially available games. 	-	<p>A brief-self report questionnaire monitored satisfaction of SPARX and OVK.</p> <p>Participants rated their liking for the two conditions in a similar way. OVK was rated as a more attractive option for adolescents and was perceived as more useful in daily life than SPARX.</p>

(Continued)

(Continued) - Table 3.

Authors (location)	Users engagement	Therapist's role	Positive opinions	Limitations/ disengagement	Suggestions for Improvement	Satisfaction assessment	
Kuosmanen et al. ²⁹ (Ireland)	Parent involvement in game assessment.	Findings indicate a need for further staff training to increase confidence in intervention delivery.	-	<ol style="list-style-type: none"> The program is boring and too easy to play, having too much talk/writing, being too slow. Need for more customization. The advice is too 'hard going' (i.e., challenging to deal with) by focusing unduly on negative aspects of mental health. 	'... perfect for people who are on a waiting list for counseling'.	A self-report questionnaire monitored satisfaction. On a scale of 1 to 10, SPARX-R received a mean overall satisfaction score of 5.78 (SD 2.79). However, more than half of the participants (53.6%) considered the program helpful for a young person going through a tough time, and only a third (32.2%) indicated that they would recommend the program to a friend. A minority (10.7%) said the program was upsetting, and a quarter (25%) stated they were worried about privacy.	
Perry et al. ²⁸ (Australia)	-	Less teacher support.	-	<ol style="list-style-type: none"> Several technical problems. Excessive load on the school information technology system associated with multiple simultaneously accessing the online research platform and downloading the SPARX-R game files. Cultural issues. 	-	-	
Sundram et al. ³⁸ (New Zealand)	Clinical and adolescent involvement in consultation and development.	Clinicians and adolescents suggested the need for a discussion around e-monitoring so that the adolescents knew that a clinician had oversight of their progress and could maintain the therapeutic relationship while enhancing their autonomy and sense of control.	<p><i>Clinicians:</i></p> <ol style="list-style-type: none"> A registration system for clinicians so that they could use the SPARX e-monitoring tool. Electronic linking of SPARX user data to the prescribing clinician. A dashboard accessible on the internet to allow clinicians to track all users they had referred to SPARX. An algorithm to automatically generate alerts at specific and concerning levels of depression or self-harm and a system to encourage users to access more help. 	<p><i>Clinicians:</i></p> Difficulty in monitoring self-harm and suicide by clinicians.	<p><i>Adolescents:</i></p> They did not want to use their social media login credentials for e-monitoring, as they valued their privacy.	The study revealed the complexity of implementing the tool in clinical practice. Of salience were privacy, parallel monitoring systems, integration with existing electronic medical record systems, customization of the e-monitor, and pre-agreed monitoring arrangements between clinicians and adolescents.	-

(Continued)

(Continued) - Table 3.

Authors (location)	Users engagement	Therapist's role	Positive opinions	Limitations/ disengagement	Suggestions for Improvement	Satisfaction assessment
Kuosmanen et al. ¹⁷ (Ireland)	Staff	Staff expressed a need for increased flexibility in delivery and complementing computerized programs with face-to-face activities to improve student engagement.	<p>5. A system to deliver alerts or "flags" via e-mail to the clinician.</p> <p><i>Adolescents:</i></p> <p>6. Most participants were positive and supportive of the idea of adding e-monitoring to enhance the effectiveness.</p> <p>7. SPARX Booklet (daily diary) helped record participants' thoughts and feelings.</p>	<p>Modules were too long, and the program was a lot of work and too slow. Worried about privacy. Too easy to play. Having too much talk/ writing.</p> <p>The need for more customization.</p> <p>The program focuses on the negative aspects of mental health.</p> <p>Technical issues (the game freezing or not saving progress) and limitations in design or gaming (graphics not being up to date, the character moving or reacting slowly, and lack of instructions).</p>	<p>Most students considered SPARX-R easy to use and agreed that the program made sense. However, less than half of the participants liked the program's look. Only a third (32.2%) indicated they would recommend the program to a friend.</p> <p>Those categorized as at risk for depression rated the program higher in relevance and usefulness than those with no symptoms or clinical symptoms of depression.</p>	<p>A brief self-report questionnaire monitored the satisfaction of the staff.</p> <ol style="list-style-type: none"> 1. The game is fun and easy to learn from. 2. Customizing your avatar. 3. Completing challenges.

(Continued)

(Continued) - Table 3.

Authors (location)	Users engagement	Therapist's role	Positive opinions	Limitations/ disengagement	Suggestions for Improvement	Satisfaction assessment
Shepherd et al. ⁴⁰ (New Zealand)	-	Not addressed.	<ol style="list-style-type: none"> 1. Customize the SPARX characters with Māori designs. 2. The SPARX Booklet (daily diary) helped record participants' thoughts and feelings. 	Participants found the puzzles to be difficult.	<ol style="list-style-type: none"> 1. Taitamariki adolescents reported the acquisition of relaxation and cognitive restructuring skills. 2. Improved mood and increased levels of hope for the participants. 3. In some instances, SPARX was used by broader family members with reported beneficial effects (family health). 	-
Fleming et al. ⁴¹ (New Zealand)	-	The absence of a therapist generates less embarrassment among the participants.	<ol style="list-style-type: none"> 1. "Universality" reflected preferences for a universal approach as young people (SPARX-R). 2. Validating a young person's depressive experiences (SPARX). 	Naming depression is risky because it could be "a little bit scary" (SPARX).	Participants considered both SPARX and SPARX-R useful and considered the stated purpose of the program to be important. Preference for both options to be offered, allowing user choice.	-
Lucassen et al. ²⁷ (New Zealand)	-	Not addressed	-	The forced gender binary is inherent in the program. Transgender had high mental health needs.	-	-
Lucassen et al. ²⁶ (New Zealand)	-	Not addressed	-	-	-	-
Bohr et al. ³⁰ (Canada, Inuit population)	Māori Taitamariki in design	-	Māori identity	the puzzles and challenges within SPARX were too easy.	-	-

Table 4. Completion of treatment, drop-out rates, and reasons for discontinuation.

Authors	Completion module 1	module 2	3 module	4 module	5 module	6 module	Completed SPARX	Drop-outs/ SPARX users (%)	Reasons for discontinuation
Fleming et al. ²²	-	-	-	26 (81%)	-	-	22 (69%)	10/32 (31%)	Running out of time in the classroom.
Merry et al. ²³	-	-	-	69 out of 80 (86%)	-	-	48 out of 80 (60%)	9/94 (9%)	Worsening of depressive symptoms and transition to more frequent face-to-face interventions; technical glitches, lack of time, lack of interest, not finding the resource helpful, being physically unwell, and unable to attend appointments.
Bobier et al. ²⁴	8 (40%)	3 (15%)	3 (15%)	1 (5%)	1 (5%)	2 (10%)	2 (10%)	18/20 (90%)	Lack of interest, lack of perceived utility, and lack of prompting by staff.
Poppelaars et al. ³¹	-	-	-	-	-	-	38 (74.5%)	13/51 (25.5%)	Unwilling to play SPARX.
Perry et al. ²⁸	-	-	-	142 (58.6%)	-	-	-	100/242 (41.4%)	Differences in motivation. Several technical problems occurred during implementation (particularly in schools allocated to the SPARX-R intervention).
Kuosmanen et al. ²⁹	-	-	-	26 (87%)	-	-	9/30 (30%)	21/30 (70%)	The program was rated as the least helpful in terms of changing behavior.

(Continued)

(Continued) - Table 4.

Authors	Completion module 1	module 2	3 module	4 module	5 module	6 module	Completed SPARX	Drop-outs/ SPARX users (%)	Reasons for discontinuation
Fleming et al. ²⁵	-	2 (10%)	-	-	-	-	-	7/19 (37%)	Two users reported that they did not like the SPARX-R program. 'It was not my thing' and 'I felt babyish'; 'it was too much talking'. Getting a private space and time on the laptop was tricky. The computer program was slow to load, and some had difficulties saving progress. The program had low technical quality and was much slower than playing games. Users arrested, court-ordered, residence change, or early discharge.
Lucassen et al. ²⁷	Transgender (n=207) 111 (53.6%) Men (n=2904) 1504 (51.8%) Women (n=5968) 3263 (54.7%) Total: 4878	-	Transgender 99 (47.8%) Men 1283 (44.2%) Women 2692 (45.1%) Total: 4074	Transgender 12 (5.8%) Men 221 (7.6%) Women 571 (9.6%) Total: 804	-	Modules 1-6 Transgender 106 (51.2%) Men 1411 (48.6%) Women 3024 (50.7%) Total: 4541	Transgender 5 (2.4%) Men 93 (3.2%) Women 239 (4%) Total: 337	8,742/9,079 (96.3%)	