Research paper

Effectiveness of a transdiagnostic computerized self-applied program targeting children with emotional problems: A randomized controlled trial

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A B S T R A C T

Background: Super Skills for Life (SSL) is an eight-session transdiagnostic program based on cognitive-behavioral therapy (CBT), aimed at the indicated prevention of childhood emotional problems, which has been implemented with positive short- and long-term results. The present study aimed to examine the effects of a self-applied computerized program based on SSL that maintains the same objectives and contents as the face-to-face program.
Methods: In this randomized controlled study, 75 children (49.3 % female) aged 8–12 years ($M_{age} = 9.45$, $SD = 1.31$), selected for exhibiting emotional symptoms, were randomly assigned to either the intervention ($n = 35$) or the waiting list control (WLC) group ($n = 40$). Pre- and post-intervention data were collected through self-reports and the report of parents who completed parallel versions of the same measures of emotional and behavioral problems.
Results: Overall, compared to the WLC group, the intervention group showed positive effects on targeted emotional symptomatology in the short term. Based on parents' reports, a significant reduction was found in outcomes such as anxiety, depression, emotional symptoms, and internalizing problems, while self-reported results were similar except for anxiety. In addition, a positive impact was found on symptoms related to other types of difficulties (e.g., externalizing problems and general difficulties measured).
Limitations: Small sample size, non-inclusion of follow-up assessment and other informants (e.g., teachers).
Conclusions: In conclusion, this research provides novel and promising data on the self-applied computerized adapted version of the SSL program, within a multi-informant approach, suggesting that it may be a useful tool for the indicated prevention of childhood emotional problems.

1. Introduction

Emotional disorders (i.e., anxiety and depression) are common psychological problems during the schoolchildren period (Bitsko et al., 2022; Canals et al., 2019), indicating that they can emerge at early ages. In particular, anxiety disorders have one of the earliest age peaks of onset, typically around 5.5 years of age (Solmi et al., 2022). Both problems, anxiety and depression, share the same etiology, tending to co-occur (Muris et al., 2017), with anxiety acting as a precursor of depression (Ghandour et al., 2019), and with an estimated comorbidity of up to 82 % (Romero et al., 2010). The comorbidity of anxiety and depression leads to a worse prognosis and a poor response to treatment (Melton et al., 2016). In addition, when anxiety and depressive symptoms are untreated, they tend to become chronic and a risk factor for

other disorders in adulthood (Essau et al., 2014). In this respect, anxiety and depression problems can have various adverse effects on children's lives and may result in long-term repercussions. These can include challenges in social and family relationships, academic difficulties, and an increased risk of developing other mental or physical health conditions (Bitsko et al., 2022). Consequently, this suggest the importance of early detection and intervention to address these issues.

Cognitive-behavioral therapy (CBT) is considered the treatment of choice for childhood emotional problems. However, an efficacy of only 50–70 % for the treated cases is estimated (Essau et al., 2012; Seligman and Ollendick, 2011). Some authors consider that the reason for this moderate percentage is that most interventions are designed for only one problem, ignoring the comorbidity with other conditions that thus remain untreated. Thus, transdiagnostic interventions were developed

to improve the treatments, addressing the frequent comorbidity of anxiety and depressive symptoms (Craske, 2012; Essau et al., 2014). Transdiagnostic approaches are cost-effective and an option for treating emotional problems in schoolchildren, enabling the treatment of several problems with the same protocol (Essau et al., 2014).

In this regard, Super Skills for Life (SSL; Essau and Ollendick, 2013), a transdiagnostic program based on CBT created to intervene in common risk factors for emotional problems in children, has yielded significant decreases in emotional symptoms. It has also been suggested that it may improve other childhood difficulties (Essau et al., 2014, 2019). The program has shown its short- and long-term efficacy for Spanish samples (e.g., Fernández-Martínez et al., 2019; Fernández-Martínez et al., 2020a; Orgilés et al., 2019), reducing emotional problems such as symptoms of anxiety and depression in school-aged children. In addition to including traditional components for treating anxiety and depression symptoms, it also incorporates more innovative strategies not yet included in any treatment protocol for children's emotional disorders, such as video feedback with cognitive preparation. In this regard, among the SSL components, we highlight the following: behavioral activation, which contributes to increasing the level of children's participation in reinforcing activities, improving their self-esteem; social skills training to help children be more socially competent and enrich their social support network; and video feedback with cognitive preparation, a technique to correct negative and distorted self-perceptions and improve anxiety and related behaviors during social interactions (Essau et al., 2014, 2019; Fernández-Martínez et al., 2020b).

Although the face-to-face program has been shown to be an appropriate resource for treating children's emotional symptoms, some obstacles may prevent children from receiving the intervention. For instance, some barriers, such as providers' location, time, transport, or costs may block access to child mental health program interventions (Bornheimer et al., 2018; Reardon et al., 2017). Thus, arises the need to develop interventions that facilitate access and delivery by taking advantage of technological advances (Bornheimer et al., 2018). An alternative that may reduce those barriers and solve the difficulties of receiving psychological treatment is the implementation of digitally delivered CBT-based interventions, such as internet-based CBT (iCBT) programs. It could be self-applied or with brief online support by therapists, and it is more flexible for the client and more cost-efficient because it allows implementers to treat more children in less time. An iCBT intervention could also be an attractive format for children (e.g., offering interactive and age-appropriate content), who are digital natives and highly familiar with the new technologies, favoring good acceptance and positive results (March et al., 2018). In fact, there is growing evidence supporting the effectiveness of digitally implemented CBT programs for the prevention and treatment of children's and adolescents' emotional problems, showing that it could be as effective as face-to-face therapy (e.g., Calear and Christensen, 2010; March et al., 2018; Spence et al., 2011; Wickersham et al., 2022). In this regard, although primarily focused on adolescents, new transdiagnostic iCBT protocols have been developed in recent years for the treatment of emotional problems, and they have shown promising results. For example, preliminary evidence has been provided on the effectiveness of transdiagnostic iCBT interventions, such as the online version of the Unified Protocol for the Transdiagnostic Treatment of Emotional Disorders in Adolescents (iUP-A; Sandín et al., 2020) and the AMTE (Learn to Manage Your Emotions; Schmitt et al., 2022) program, which is based on the UP-A. Additionally, Păsărelu et al. (2021) have presented preliminary evidence on the efficacy of an internet-delivered intervention based on rational emotive behavioral therapy (REBT).

Therefore, as the SSL program obtained good results in reducing emotional symptoms in children aged 8 to 12 years, its adaptation to a computerized format as a transdiagnostic iCBT intervention could have several potential advantages, including facilitating its access to a high number of children and reducing waiting time to receive treatment. The SSL program adapted for online implementation has the same objectives

and includes the same techniques and activities as the face-to-face version. Although the online program may be self-applied by the child, the parents receive a written guide to help their children when needed, and a therapist is at their disposal to solve possible problems during the implementation. Considering some families' obstacles to accessing psychological treatment, the objective of the present randomized controlled trial was to examine the effectiveness of a self-applied computerized intervention based on the CBT transdiagnostic SSL program. This is the first digital protocol aimed at reducing anxiety and depression symptoms in Spanish school-aged children (8–12 years) compared to a waiting list control (WLC) group.

2. Methods

2.1. Participants

Table 1 shows the participants' characteristics and the pretest equivalence in the sociodemographic variables of the intervention and WLC groups. Of all participants ($N = 75$), approximately half were female (49.3 %) or male (50.7 %), and the mean age was 9.45 ($SD = 1.31$). Most participants were born in Spain (89.3 %), and all were Spanish-speaking. The number of siblings ranged between 0 and 4 ($M = 1.01$, $SD = 0.86$). The mothers were mainly the ones who completed the parental evaluation (84 %). Two-thirds of the parents were married (77.3 %), while the rest were separated or divorced (14.7 %) or had another family situation (i.e., single or widowed, 5.3 % and 2.7 % respectively). The parent's educational level was varied, with a predominance of parents with higher education (44 %). Regarding employment, the most reported were having a full-time job (48 %), a part-time job (18.7 %) or being unemployed (18.7 %). The sectors in which most of them worked were education (17.3 %), health/social services (14.7 %), trade (14.7 %), scientific/technical professional (12 %), and information/communication (12 %). The family income was variable, with the most frequently reported range being from 1000 to 1999 euros, accounting for 28 % of the cases.

2.2. Measures

2.2.1. Self-reported

Brief version of the Spence Children's Anxiety Scale (SCAS-C-8; Reardon et al., 2018). The SCAS-C-8 is an eight-item self-report measure of children's anxiety symptoms based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013). Children are asked to rate their anxiety symptoms on a 4-point Likert scale, ranging from 0 (*never*) to 3 (*always*). An overall anxiety score is obtained through the sum of all items, with higher scores indicating greater symptom severity. In this study, the Spanish version was administered, which has shown good psychometric properties (Rodríguez-Menchón et al., 2022), in line with the original study of Reardon et al. (2018). The reliability of the SCAS-C-8 total score for the sample was acceptable (ordinal $\alpha = 0.68$).

Short Mood and Feelings Questionnaire (SMFQ; Angold et al., 1995). The SMFQ is a self-report to assess depression symptoms in children. It comprises 13 items rated on a 3-point scale, ranging from 0 (*not true*) to 2 (always *true*). A total score is derived from the sum of all the scores, with higher scores indicating greater symptom severity. The Spanish version of the SMFQ, whose reliability and validity have been supported, was used in this research (Espada et al., 2022). In this study, the reliability of the SMFQ total score was good (ordinal $\alpha = 0.89$).

The Strengths and Difficulties Questionnaire (SDQ; Goodman, 2001). The SDQ is a 25-item self-report comprising five subscales. A total difficulties score can be obtained by adding all the subscales except for the Prosocial subscale. Items are rated on a 3-point scale, ranging from 0 (*not true*) to 2 (*certainly true*). Overall, higher scores indicate more problems, whereas the Prosocial behavior subscale is interpreted reversely. This measure also provides scores on the Internalizing

Table 1
Sociodemographic baseline characteristics of participating children and their parents by intervention condition.

Characteristics	Intervention program (*n* = 35)	WLC (*n* = 40)	Total (*n* = 75)	Test[a]	*p*-Value
Children					
Female, *N* (%)	16 (45.7)	21 (52.5)	37 (49.3)	0.34	0.55
Mean age (*SD*), years	9.26 (1.26)	9.63 (1.35)	9.45 (1.31)	1.20	0.23
Spanish nationality	32 (91.4)	35 (87.5)	67 (89.3)	5.82	0.44
Mean number (*SD*) of siblings	1.09 (1.09)	0.95 (0.60)	1.01 (0.86)	−0.67	0.50
Parents					
Respondent, *N* (%)					
Mother	28 (80)	35 (87.5)	63 (84)	1.52	0.46
Father	6 (17.1)	5 (12.5)	11 (14.7)		
Other	1 (2.9)	0 (0)	1 (1.3)		
Family situation, *N* (%)					
Married	22 (62.8)	36 (90)	58 (77.3)	8.35	0.04
Separated or divorced	8 (22.9)	3 (7.5)	11 (14.7)		
Single	3 (8.6)	1 (2.5)	4 (5.3)		
Widowed	2 (5.7)	0 (0)	2 (2.7)		
Education, *N* (%)					
Primary education	7 (20)	4 (10)	11 (14.7)	6.99	0.07
Secondary education	10 (28.6)	11 (27.5)	21 (28)		
Higher education	17 (48.6)	16 (40)	33 (44)		
Master's or PhD	1 (2.8)	9 (22.5)	10 (13.3)		
Employment, *N* (%)					
Full time	18 (51.4)	18 (45)	36 (48)	2.39	0.88
Part-time	6 (17.1)	8 (20)	14 (18.7)		
Unemployed	6 (17.1)	8 (20)	14 (18.7)		
Student	1 (2.9)	1 (2.9)	2 (2.7)		
Public employee	1 (2.9)	0 (0)	1 (1.3)		
Record of Temporary Employment Regulation	0 (0)	1 (2.5)	1 (1.3)		
Self-employed	3 (8.6)	4 (10)	7 (9.3)		
Laboral sector, *N* (%)					
Teaching	5 (14.3)	8 (20)	13 (17.3)	7.85	0.64
Finance/insurance	2 (5.7)	2 (5)	4 (5.3)		
Hostelry	0 (0)	1 (2.5)	1 (1.3)		
Building	2 (5.7)	0 (0)	2 (2.7)		
Administrative	4 (11.4)	3 (7.5)	7 (9.3)		
Scientific/technical professional	4 (11.4)	5 (12.5)	9 (12)		
Trade	6 (17.2)	5 (12.5)	11 (14.7)		
Information / Communication	3 (8.5)	5 (12.5)	9 (12)		
Health / Social Services	7 (20)	4 (10)	11 (14.7)		
Transport / Storage	1 (2.9)	4 (10)	5 (6.7)		
Manufacturing industry	1 (2.9)	3 (7.5)	4 (5.3)		
Income, *N* (%)					
Up to 499 euros	1 (2.9)	0 (0)	1 (1.3)	4.69	0.58
500–999 euros	5 (14.3)	6 (15)	11 (14.7)		
1000–1999 euros	11 (31.4)	10 (25)	21 (28)		

Table 1 (*continued*)

Characteristics	Intervention program (*n* = 35)	WLC (*n* = 40)	Total (*n* = 75)	Test[a]	*p*-Value
2000–2999 euros	6 (17.1)	8 (20)	14 (18.7)		
3000–4999 euros	5 (14.3)	11 (27.5)	16 (21.3)		
5000 or more	1 (2.9)	2 (2.7)	3 (4)		
Prefer not to answer	6 (17.1)	3 (7.5)	9 (12)		

[a] Test: Chi-Square for categorical variables and Student-t for continuous variables; *SD* = Standard Deviation. WLC = Waiting List Control group.

Problems subscale (by adding the scores of the Emotional Symptoms –i. e., anxiety and depressive symptoms– and Peer Relationship Problems subscales) and the Externalizing Problems subscale (by adding the scores of the Conduct Problems and Hyperactivity/Inattention subscales). The psychometric properties of the SDQ have been shown to be good in Spanish population (e.g., Ortuño-Sierra et al., 2016). In this study, which used the Spanish version, the reliability was adequate for all the subscales —including the Internalizing Problems and Externalizing Problems subscales (ordinal alphas ranging from 0.70 to 0.83 for Conduct Problems and Prosocial Behavior, respectively) and the SDQ total score —Total Difficulties score– (ordinal alpha = 0.83).

2.2.2. Parent's reports

Brief Parent Version of the Spence Children's Anxiety Scale (SCAS-P-8; Reardon et al., 2018). The SCAS-P-8 was developed from the extended version of the original SCAS. This brief questionnaire provides a global score of child anxiety from the parent's perspective. Similar to the self-report version, it contains 8 items rated on a 4-point Likert scale (from 0 = *never* to 3 = *always*), displaying good psychometric properties (Orgilés et al., 2022; Reardon et al., 2018). Higher scores indicate higher levels of children's anxiety. In the current study, the Spanish version of the SCAS-P-8 was used, finding adequate reliability (ordinal α = 0.79).

Short Mood and Feelings Questionnaire-Parent version (SMFQ-P; Angold et al., 1995). The SMFQ-P is the parent-report version of the SMFQ, which contains 13 items measuring children's depressive symptoms. Parents are asked to rate the items on a 3-point scale (from 0 = *not true* to 2 = *always true*). The sum of all the items' scores yields a global score of depression, with higher scores indicating higher levels of children's depressive symptoms. The psychometric properties of the SMFQ-P have been supported for use with Spanish children (Fernández-Martínez et al., 2020c). In this study, the reliability of the SMFQ total score was good (ordinal α = 0.80).

The Strengths and Difficulties Questionnaire-Parent version (SDQ—P; Goodman, 2001). The SDQ-P is the parent-report version of the SMFQ. Like the self-reported version, it contains 25 items assessing emotional and behavioral difficulties and positive behaviors, using the same rating scale and subscales. Higher scores indicate more difficulties, whereas the Prosocial subscale is interpreted reversely. The adequate psychometric properties of the SDQ-P in Spanish population have been reported (Rodríguez-Hernández et al., 2012). In the current study, the Spanish version was used, finding a good ordinal alpha for the Total Difficulties score (α = 0.83), and ranging from 0.70 (Conduct Problems) to 0.82 (Peer Relationship Problems) for the subscales.

2.3. Procedure

This study targeted Spanish-speaking children aged 8–12 years who might present emotional symptomatology. The target population aligned with the original face-to-face version, as described in previous research (e.g., Orgilés et al., 2019). To select participants, a score equal of 4 or higher on the Emotional Symptoms subscale of the SDQ parent version (Goodman, 2001) was considered, following the methodology employed in earlier studies (e.g., Fernández-Martínez et al., 2019;

Orgilés et al., 2019) that also used this SDQ cut-off score. Dissemination was carried out through different sources (e.g., social networks, advertisements in print and digital media, emails). Information was provided about the purposes of the study, the target age range, with a link to a web page about the program so that recipients could access more detailed information. Additionally, an online form was made available for parents to voluntarily participate if they chose to do so. Interested families provided sociodemographic data and completed a battery of questionnaires about their child. Once participants were selected, they were randomly assigned to the intervention or waiting list control (WLC) group. Before starting the program, each child was asked to complete the self-reports of the study. Each week the children completed two sessions of the program, completing it in a total of four weeks. The sessions were progressively enabled as they completed the previous session and the homework (called Supertasks in the program), leaving a space of three days between sessions. After completing the last session, the program platform generated a personalized certificate of participation that the children could download and keep, acknowledging their effort and participation during the program. Contact with families was fluid, mainly through email and phone messaging/call. These channels were used to resolve doubts and provide information of interest (e.g., the schedule of sessions, the possibility of accessing the next session). A weekly communication plan was implemented to maintain contact with all the participating families. This involved using established channels to share relevant information regarding each session. Additionally, the therapists were available to address any inquiries or concerns raised by the families through various communication channels. This support was provided during the afternoon hours throughout the week, which coincided with the typical session completion time for the children. In addition, families had online access to written information about each session, including objectives and activities included in the session, tasks to be completed by their child before the next session, and some guidelines related to what was taught in the session. For this purpose, an online free access platform was also made available exclusively for the participating families. After completing the program, parents and children were asked to complete the posttest evaluation. All the children in the WLC group subsequently received the same intervention. In the current research, families did not receive any incentives for participation and informed consent was obtained from parents for the participation of their selected children. This study was approved by the ethical committee of the authors' institution.

2.3.1. Study design

The cases that obtained a score of 4 or higher on the emotional symptoms subscale of the SDQ were assigned randomly to either the intervention program or the WLC group. The groups were balanced in terms of sex and age. All participants in the experimental group completed the treatment.

2.4. Intervention

The intervention was based on the SSL program, so the objectives remained the same as for the face-to-face program (e.g., Essau et al., 2014; Orgilés et al., 2019), but all the activities were adapted to the implementation in a self-applied computerized format. The intervention consists of 8 sessions lasting about 35 min each, based on the time needed for each child to complete the activities in this format. Taking advantage of technology, two digital characters who are a coping model for the children guide each session, providing information about the tasks that the children should perform during the program. Therefore, the online version of the program provides several advantages compared to the face-to-face format. It enables shorter, more frequent sessions to take place throughout the week. Additionally, the online format promotes greater participants autonomy, as children are dynamically guided by the platform and interactive characters that serve as coping models. Each session starts by explaining the specific objectives and

ends with a brief summary of the learned contents. All the activities of the face-to-face version were adapted to be completed by the children without therapist supervision. Some exercises provided immediate feedback to the children about their responses, and all the children's answers were submitted to a control panel for supervision by a therapist. In this regard, the therapists had access to continuous feedback on the participants' performance, as all their responses were recorded in the program's control panel. This included written answers in open-ended exercises, identification of errors in multiple-choice exercises, and the time taken to answer. As part of the program, a homework task was assigned in each session, which served to facilitate the practical application of the skills learned in real-life situations. Using the platform, children were also required to provide written feedback on their experience and their performance by answering a series of questions posed to them within each homework task, know as the Supertask of the program. The parents received written information for each session, including the objectives of the session and some tips to help their children if needed in some exercise. A therapist was available for parents by phone and email to solve any doubts and provide relevant information.

2.5. Statistical analyses

All the cases that presented the pretest and posttest evaluations were analyzed. *T*-Student (for quantitative variables) and Cross-table (for qualitative variables) were applied to verify the pretest equivalence of the two groups in the sociodemographic and outcome variables. Attrition analyzes were applied to identify if there were differences between children who dropped out of the study and those who did not.

The short-term effects of the program in the intervention group compared to the WLC group were evaluated using generalized estimating equations (GEE), adjusting for the baseline measure of the outcome, age, and gender. Randomized controlled trials are mostly evaluated with GEE because it controls correlations among responses, and is a potent strategy even when the sample is not very large (Liang and Zeger, 1986). Each variable was tested independently, and the subjects were the randomization units. Ordinal alpha was calculated to provide evidence of the reliability of the instruments used with the study sample. In addition, the Cohen's (1988) effect size (*d*) was calculated when the differences were statistically significant. The Cohen's d is interpreted as follows: Small effect: $d = 0.2$, medium effect: $d = 0.5$, and large effect: $d = 0.8$. For this purpose, *R* Studio was used. The rest of the analyses were carried out using SPSS v28.

3. Results

3.1. Attrition

Flow of participants through each stage of the study is illustrated in Fig. 1. When comparing allocated cases to the experimental conditions and the cases who received the intervention and provided at least pre and post-intervention measures, the return rate was 65.78 %. Analyzes revealed that the odds of dropping out was similar in the experimental group and waiting list group ($p = .50$). Dropping out was unrelated to child' age ($p = .82$), child's sex ($p = .79$), number of siblings ($p = .15$), parental marital status ($p = .27$), and parent educational level ($p = .86$). There were also no statistically significant differences in measures of depression (SMFQ), anxiety (SCAS) and difficulties and strengths (SDQ) in both self-report and parent report between the children who did not respond to the post-test and those who did it ($p > .05$).

3.2. Baseline equivalence

The intervention and WLC groups were equivalent in the sociodemographic variables, except for the family's situation. A higher proportion of children in the WLC group had parents who were married compared to the intervention group (90 % vs. 63.8 %; $p = .04$, Cramer's

CONSORT

TRANSPARENT REPORTING of TRIALS

CONSORT 2010 Flow Diagram

Enrollment

Assessed for eligibility (n= 313)

Excluded (n= 199)
- Not meeting inclusion criteria of score ≥ 4 in EMO of SDQ-P (n= 183)
- Declined to participate (n= 13)
- Other reasons (n= 3)

Randomized (n= 114)

Allocation

Allocated to **Super Skills for Life** (n=55)
- Received allocated intervention (n= 55)
- Did not receive allocated intervention (n=0)

Allocated to the **waiting list group** (n= 59)

No equivalent intervention was provided.

Follow-Up

Discontinued intervention (technical problems, lack of time, unknown reasons) (n= 20)

Lost to follow-up (children did not respond the posttest due to unknown reasons) (n= 19)

Analysis

Analysed (n= 35)
- No cases were excluded from analysis

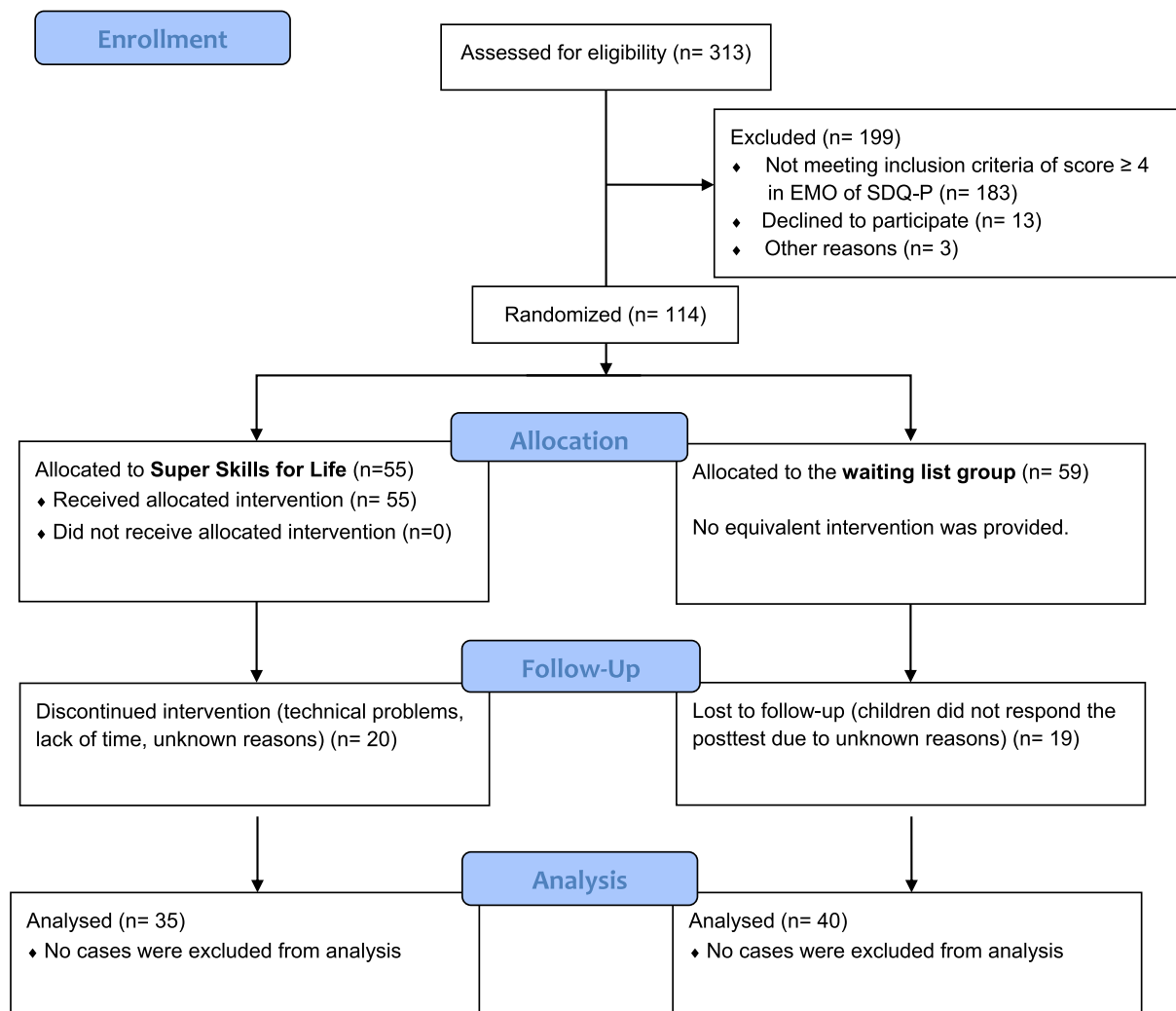Analysed (n= 40)
- No cases were excluded from analysis

Fig. 1. Flow diagram of participants through each stage of the study.

$V = 0.33$). The two groups did not differ in the outcome variables in the pretest.

3.3. Immediate effects of the intervention

Table 2 shows pretest and posttest means (*SD*) of the outcomes for the intervention and control conditions, and the immediate results for the generalized linear model-based estimates with 95 % confidence intervals (CI), the significance tests for the effect of the intervention on the outcomes according to the children's and parents' reports, and Cohen's effect size for statistically significant differences.

According to the children's reports, the intervention program had a statistically significant effect in 7 of the 10 outcomes. Compared to the

WLC group, at the posttest, children in the intervention group presented lower scores in Depression, Total Difficulties, Emotional Symptoms, Hyperactivity/Inattention Symptoms, Peer Relationship Problems, and Internalizing and Externalizing Problems. Effect sizes of these diiferences were large, as shown in Table 2.

According to the parents' reports, the intervention program also had a statistically significant effect in 7 of the 10 outcomes. Compared to the WLC group, at posttest, children in the intervention group presented lower scores in Depression, Anxiety, Total Difficulties, Emotional Symptoms, Conduct Problems, and Internalizing and Externalizing Problems. Effect sizes of these differences were also large (Table 2). The intervention's effect on reducing hyperactivity/inattention symptoms was marginally significant ($p = .07$).

Table 2

Pretest and posttest means (SD) of the outcomes for the intervention and control conditions, generalized linear model-based estimates with 95 % confidence intervals (CI), and significance tests for the intervention's effect on the outcomes according to the children's and parents' reports.

Outcomes	Intervention program		WLC		Pre-post		Cohen's *d*
	Pre (*n* = 35)	Post (*n* = 35)	Pre (*n* = 40)	Post (*n* = 40)	Estimates (95 % CI)	*p*-Value	
Child's report							
Depression (SMFQ total score)	8.45 (4.95)	6.18 (0.73)	8.89 (5.24)	8.36 (0.75)	2.18 (0.10, 4.26)	0.04	2.94
Anxiety (SCAS total score)	8.63 (4.12)	7.08 (0.45)	9 (3.85)	7.39 (0.45)	0.31 (−0.95, 1.57)	0.63	–
Total difficulties (SDQ total score)	16.03 (6.09)	10.90 (0.94)	14.90 (6.22)	15.13 (0.93)	4.22 (1.60, 6.84)	0.002	4.52
Emotional symptoms	4.69 (2.55)	2.82 (0.37)	4.53 (2.50)	4.20 (0.36)	1.37 (0.34, 2.40)	0.009	3.78
Conduct problems	2.89 (1.89)	2.49 (0.28)	3.25 (1.93)	2.72 (0.28)	0.23 (−0.55, 1.02)	0.56	–
Hyperactivity/Inattention	5.51 (2.40)	3.77 (0.40)	4.95 (2.41)	5.26 (0.40)	1.48 (0.35, 2.62)	0.01	3.72
Peer relationship problems	2.94 (2.15)	1.85 (0.30)	2.17 (2.08)	2.93 (0.29)	1.07 (0.23, 1.92)	0.01	3.66
Prosocial behavior	7.86 (1.86)	8.35 (0.44)	8.45 (1.89)	8.52 (0.44)	0.17 (−1.08, 1.43)	0.78	–
Internalizing problems	7.63 (3.59)	4.72 (0.53)	6.70 (3.72)	7.08 (0.52)	2.35 (0.87, 3.83)	0.002	4.49
Externalizing problems	8.40 (3.36)	6.27 (0.59)	8.20 (3.65)	7.96 (0.58)	1.69 (0.04, 3.33)	0.04	2.88
Parental reports							
Depression (SMFQ total score)	10.23 (4.69)	5.32 (0.63)	10 (3.96)	8.84 (0.59)	3.51 (1.80, 5.22)	<0.001	5.76
Anxiety (SCAS total score)	11.43 (3.82)	7.68 (0.57)	10.75 (4.34)	10.34 (0.54)	2.65 (1.09, 4.22)	<0.001	4.79
Total difficulties (SDQ total score)	17 (5.87)	4.40 (0.29)	18.02 (5.34)	5.13 (0.28)	3.08 (1.18, 4.99)	0.001	2.56
Emotional symptoms	5.80 (1.79)	3.61 (0.33)	6.13 (1.63)	5.02 (0.31)	1.40 (0.49, 2.31)	0.003	4.40
Conduct problems	2.71 (1.87)	2.24 (0.21)	3.10 (1.85)	2.89 (0.20)	0.65 (0.07, 1.23)	0.02	3.16
Hyperactivity/Inattention	5.31 (3.02)	4.40 (0.29)	5.38 (2.88)	5.13 (0.28)	0.73 (−0.07, 1.54)	0.07	–
Peer relationship problems	3.17 (2.62)	2.64 (0.27)	3.43 (2.67)	3.12 (0.26)	0.48 (−0.27, 1.23)	0.21	–
Prosocial behavior	7.09 (2.36)	7.88 (0.25)	7.50 (1.96)	7.52 (0.24)	−0.36 (−1.06, 0.33)	0.30	–
Internalizing problems	8.97 (3.45)	6.24 (0.51)	9.55 (3.23)	8.15 (0.48)	1.91 (0.51, 3.30)	0.007	3.85
Externalizing problems	8.03 (4.09)	6.65 (0.38)	8.48 (4.24)	8.01 (0.36)	1.35 (0.31, 2.40)	0.01	3.67

WLC = Waiting List Control group. Cohen's *d* = effect size.

4. Discussion

The main aim of the present randomized controlled trial was to examine for the first time the immediate effects of a self-applied computerized online intervention based on the SSL transdiagnostic program with school children aged 8–12 years. For this purpose, children's and parents' reports on the same instruments, in both the self-report and the parallel parent-report version, were administered and analyzed.

This intervention targeted children presenting initial emotional symptoms, with the main interest being the program's effect on these symptoms. Thus, compared to the WLC group, emotional symptoms (i. e., anxiety and depression) and internalizing problems as measured by the SDQ, as well as depressive symptoms as measured by the SMFQ, decreased in the intervention group, based on the children's and parents' reports. In addition, according to the parents' reports, the symptoms of anxiety measured by the SCAS improved at posttest compared to the WLC group. These positive short-term results are in line with similar previous studies using the SSL program (e.g., Essau et al., 2019; Fernández-Martínez et al., 2019; Melero et al., 2021; Orgilés et al., 2019), suggesting that the computerized intervention may also have immediate effects on these symptoms.

In the children's reports, no significant effect was found in the specific measure of anxiety (i.e., SCAS-C-8). However, it is worth mentioning that the pre-posttest means suggested a positive trend. Although there is no clear explanation for this finding, children may have had some comprehension difficulties when answering this measure autonomously, or they may not have perceived short-term improvements in aspects mentioned in this tool; for example this could be due to limitations such as insufficient time to fully integrate all the acquired skills or effectively apply them in their day-to-day lives. Concerning the latter, as found in previous experiences with the program, in subsequent long-term evaluations, the results may improve as children have more time and opportunities to practice and integrate what they learned into their daily lives (e.g., Essau et al., 2014; Orgilés et al., 2019).

Moreover, compared to the WLC group, children in the intervention condition showed improvements from pretest to posttest on a range of secondary outcomes measured through the SDQ. There was agreement among informants, finding a significant reduction in externalizing problems and general difficulties (total SDQ score), which includes both internalizing and externalizing problems. There were some discrepancies between informants on the results of other variables. Only the parents' assessment showed improvements in the Conduct Problems subscale, whereas only the children's assessment reported improvements in the Hyperactivity/Inattention and Peer Relationship Problems subscales. Nevertheless, altogether, these significant improvements are also in line with previous findings in the face-to-face SSL program at posttest and/or follow-up (e.g., Melero et al., 2021; Orgilés et al., 2019), reflecting that this transdiagnostic intervention, originally designed to address emotional problems, could also provide benefits for other types of difficulties that may be present.

The authors do not have a clear explanation for the discrepancies between informants found in the SDQ outcomes. However, this is in keeping with the previously noted lack of consensus between informants on SSL findings with the SDQ subscales (Essau et al., 2019). Informant discrepancies in assessing youth mental health problems seem to be common and should be considered (see De Los Reyes et al., 2019, 2022). Overall, our results also highlight the importance of considering the perspective of different informants when evaluating the effects of interventions targeting children. It would be interesting to see whether and in which direction the discrepancies found may change in the long term through follow-up assessments.

4.1. Limitations

This study has some limitations to be considered. First, the sample size was small. This could affect the generalizability of the results or other aspects, such as the statistical power of the analyses in this study. Second, although this study collects reports from parents and children, it would be interesting to consider other significant informants (e.g., teachers) to follow a more comprehensive multi-informant approach. Third, this study examined the immediate effects of the intervention using a pre-post design. Therefore, conducting a follow-up study is recommended to assess whether the effects persist or change over the long term.

4.2. Conclusions

Despite the above limitations, the present study offers novel data from the self-applied computerized intervention based on SSL transdiagnostic program, through a randomized controlled trial with children aged 8 to 12 years exhibiting emotional symptoms, and following a multi-informant approach by including child and parent reports. The results of this trial show immediate positive effects on many variables, with improvements in targeted emotional symptomatology. In addition, it reveals a positive impact of this internet-based format of the program on symptoms related to other types of difficulties (e.g., externalizing problems and general difficulties as measured by the SDQ). Thus, for the first time, this research provides promising data suggesting that this transdiagnostic, computerized CBT intervention may become a useful tool, along with adequate professional support, for the indicated prevention of children's emotional problems, offering the advantages of an online format (i.e., easy access and usability by children and families) from home or any geographical location. Therefore, it would be worthwhile to continue analyzing the effectiveness of this intervention in future research through studies with larger sample sizes and longitudinal data collection while maintaining the multi-informant assessment approach.

CRediT authorship contribution statement

All authors contributed to and have approved the final manuscript.
Mireia Orgilés: Conceptualization, Investigation, Resources, Supervision, Project administration, Funding acquisition. **Alexandra Morales:** Methodology, Validation, Visualization, Formal analysis, Writing-Original draft preparation. **Iván Fernández-Martínez:** Investigation, Data curation, Visualization, Writing- Original draft preparation. **Xavier Méndez:** Supervision, Writing - Review & Editing. **José Pedro Espada:** Conceptualization, Resources, Supervision, Writing - Review & Editing.

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Declaration of competing interest

The authors have no conflict of interest to report in relation to the research presented in this manuscript.

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