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The relative effectiveness of problem-solving skills on the effectiveness of Cognitive Behavioural Therapy among adolescents with subclinical depressive symptoms

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Foreword

In this paper I will describe the process and results of my Master's research. To me this master's thesis is the finishing work of my studies in Clinical Child, Family and Education Studies (*orthopedagogiek*), and the result of putting together a lot of new knowledge and practical clinical skills. At the same time, this thesis means the completion of five years of studying at Utrecht University.

My decision to participate in this project stemmed from my personal experience with Cognitive Behavioral Therapy. As someone who had the experience of receiving and undergoing the process of CBT myself, I wanted to know more about the principles of CBT and the underlying mechanisms that make it effective. Designing and carrying out the research has been an enrichment to my development as a clinical professional, although it was stressful at times. This was especially true for the period between November and March, when writing and collecting data took place simultaneously. Despite this stressful period, I am very grateful that I got the opportunity to receive training in and gain experience with the K-SADS, a diagnostic instrument to identify depressive symptoms and disorders among children and adolescents. The adolescents I got to know during the administration of the K-SADS taught me more about depression and interviewing them made me grow as a clinical professional.

It has taken hard work and dedication, but that makes me even prouder of the result. For this, I want to thank my supervisors who were basically 24/7 available to solve the hurdles that were encountered along the way. I particularly appreciated the personal meetings with my supervising lecturer. I often entered these meetings feeling quite stuck, not knowing what to do next. But she always made my big problems look like small adaptations, and that is how she managed to make me feel quite confident about my writing process in general.

Last but not least, I want to thank my parents and loved ones, who have always supported my studies from the very start. They never stopped believing in me even at times when I did not, and without them I would not even be writing this at the moment. I will always be grateful that my parents encouraged me and gave me the opportunity to study at university.

Abstract

Background: Cognitive Behavioral Therapy (CBT) has proven to be effective in preventing and treating depression among adolescents. However, the effect might not be the same for all adolescents. Determining what differentiates those who do versus who do not benefit from CBT is therefore a task of significant importance. The first aim of the study was to determine the relative effectiveness of a problem-solving module on the level of subclinical depressive symptoms, compared to modules focusing on cognitive restructuring, activity scheduling and relaxation training. The second aim of the study was to examine to what extent the level of problem-solving skills pretreatment moderates the relationship between the level of subclinical depressive symptoms pre- and posttreatment, when a problem-solving module is offered.

Method: This study is part of the STARr-project, an intervention program which is designed as a randomized controlled trial (RCT) with four parallel conditions ($n = 211$). In this study, the outcome of the first three sessions of the intervention program were the primary focus. Within each condition, one of four CBT-modules was completed.

Results: Adolescents who completed the problem-solving module reported no different levels of subclinical depressive symptoms posttreatment than adolescents who completed one of the three other modules. Besides, the level of subclinical depressive symptoms after a problem-solving module is likely moderated by problem-solving skills pretreatment.

Conclusions: A focus on changing the overall problem-solving orientation, including accompanying problem-solving techniques, may reduce subclinical depressive symptoms. Suggestions for future research are discussed.

Keywords: Depression, subclinical symptoms, adolescents, Cognitive Behavioural Therapy, problem-solving skills, prevention, moderator, moderation

The relative effectiveness of problem-solving skills on the effectiveness of Cognitive Behavioural Therapy among adolescents with subclinical depressive symptoms

Depression is a disabling, and recurrent condition that often begins in adolescence (Avenevoli, Knight, Kessler, & Merikangas, 2008). Approximately 5% of adolescents suffer from depression worldwide (Costello, Erkanli, & Angold, 2006; World Health Organization, 2012). Subclinical prevalence rates are even higher: 15-20% of adolescents experience subclinical symptoms of depression during the teenage years (Kessler, Avenevoli, & Merikangas, 2001). Depressive disorders have profound effects on the quality of life, including interpersonal relationships and academic achievement (Jones et al., 2017; Saarni et al., 2007). Moreover, it is associated with increased rates of suicide, high levels of service use and substantial societal costs (Van Zoonen et al., 2014). This also applies to adolescents with subclinical depressive symptoms (Cuijpers et al., 2014). Therefore, preventing depression among adolescents is a serious and pressing public health priority (Garber et al., 2018).

Cognitive Behavioural Therapy

One of the most used preventive methods for depression among adolescents is Cognitive Behavioural Therapy (CBT). CBT includes interventions that seek to promote emotional and behavioural change by teaching clients to change cognitive processes in an overt, active, and problem-oriented manner (Reinecke, Ryan, & DuBois, 1998). For depression, CBT involves encouraging the adolescent to reflect on cognitions and modify unrealistic views (Beck, Rush, Shaw, & Emery, 1979). As maladaptive thoughts maintain emotional distress and dysfunctional behaviour, changing these thoughts as well as improving competence in coping skills are key factors in reducing depressive symptoms (Strunk, Adler, & Hollars, 2013). The efficacy of CBT in preventing and treating depression among adolescents is confirmed by numerous Randomized Controlled Trials (Clarke, Rohde, Lewinsohn, Hops, & Seeley, 1999; Garber et al., 2018) and meta-analyses (Cuijpers et al., 2013; Klein, Jacobs, & Reinecke, 2007).

Why does CBT work?

Despite these encouraging findings, so far little is known about the relative effectiveness of CBT-modules on decreasing depressive symptoms (Bennet-Levy, 2003; Kennard et al., 2009). Additionally, the effect of CBT might not be the same for all adolescents (Garber et al., 2018). Therefore, determining what differentiates those who do versus who do not benefit from CBT is a task of significant importance. This includes investigating the relative effectiveness of separate modules of CBT at first. Subsequently, becoming aware of moderators can suggest ways to modify the preventive interventions to make them more effective (Garber et al., 2018).

Key modules of CBT

CBT aims to change how a person thinks and acts, which is why CBT contains both cognitive and behavioural modules. Cognitive restructuring is considered as a key cognitive module, whereas activity scheduling and relaxation training are regarded as key behavioral modules. Some modules involve a combination of cognitive and behavioural techniques, which is the case for improving problem-solving skills. First, Cognitive restructuring involves identifying, challenging and altering stress-inducing thought patterns and beliefs (Kazantzis, Fairburn, Padesky, Reinecke, & Teesson, 2014). Second, activity scheduling focuses on behavioural activation and promotes rewarding activities, which leads to improved mood (Emery, 2000; Macrodimitris, Hamilton, Backs-Dermott, & Mothersill, 2010). Third, progressive relaxation training may be used to reduce levels of stress and/or anxiety in social situations or situations involving problem-solving (Alavi & Omrani, 2019; Rohde, Feeny, & Robins, 2005). At last, enhancing problem-solving skills is also considered a key module within CBT. Problem-solving skills are usually taught by means of a variant of the following steps: identify the problem, brainstorm, choose a solution, and evaluate the solution (Rohde et al., 2005).

CBT and problem-solving skills

Problem-solving skills refer to “the cognitive-behavioural process by which individuals discover or identify effective means of coping with problematic situations encountered in daily living” (Nezu, Nezu, Saraydarian, Kalmar, & Ronan, 1986, p. 490). Problem-solving skills are frequently associated with the etiology of depression among adolescents in the literature (Anderson, Goddard, & Powell, 2011; Hasegawa, Kunisato, Morimoto, Nishimura, and Matsuda, 2018). Various studies conclude that relatively few problem-solving skills operate as a significant predictor for future depressive symptoms (Anderson et al., 2011; Reinecke, DuBois, & Schultz, 2001). This is why several studies suggest that treatment sessions that focus on changing the overall problem-solving orientation, including accompanying problem-solving techniques, may improve the effectiveness of intervention programs for depressive symptoms (Hasegawa et al., 2018; Keller et al., 2000; Nezu, Nezu, & Perri, 1989). Additionally, in one previous study where the dose-response effect of eight different CBT-modules among adolescents was compared, findings supported the added value of problem-solving for depressive symptoms (Kennard et al., 2009). The current study builds on these previous studies by examining the impact of a problem-solving skills module within CBT on subclinical depressive symptoms among adolescents.

Problem-solving skills as a moderator

There is consistent evidence that problem-solving skills are significantly related to depressive symptoms. Nezu et al. (1986) found that problem-solving skills operate as a moderator on the relationship between negative stressful life events and depressive symptomatology. Individuals who are better able to cope with negative stressful life events as a result of more effective problem-solving skills, report fewer depressive symptoms than individuals with less effective problem-solving skills. A possible explanation is that individuals with ineffective problem-solving skills have less adequate coping strategies for dealing with problems and difficulties (Nezu et al., 1986). This problem-solving model of depression has been supported by various following studies (Blankstein, Flett, & Johnston, 1992; Cannon et al., 1999; Channon & Baker, 1996). A more recently conducted study, focusing on adolescents specifically, concluded that high pretreatment levels of depressive symptoms are associated with more negative life events and a more negative problem-solving orientation (Spence, Sheffield, & Donovan, 2002). Nevertheless, neither of these studies focused on the possibility of a moderation effect of problem-solving skills prior to an intervention on (subclinical) depressive symptoms in relation to treatment outcome, or a problem-solving module specifically. Investigating this possibility is useful, as this gives more insight in what kind of treatment may be more effective for specific clinical groups.

Research questions

1. What is the relative effectiveness of a problem-solving module within CBT on the level of subclinical depressive symptoms among adolescents, compared to modules focusing on cognitive restructuring, activity scheduling and relaxation training?
2. To what extent does the level of adolescents' problem-solving skills pretreatment moderate the relationship between the level of subclinical depressive symptoms pre- and posttreatment, when a problem-solving module is offered?

Along with these research questions, the following hypotheses are formulated:

1. A problem-solving module within CBT is significantly more effective in reducing subclinical depressive symptoms among adolescents than modules focusing on cognitive restructuring, activity scheduling and relaxation training.
2. The level of adolescents' problem-solving skills pretreatment operates as a moderator on the relationship between the level of subclinical depressive symptoms pre- and posttreatment, when a problem-solving module is offered. Adolescents with a lower level of problem-solving skills pretreatment show a lower level of subclinical depressive symptoms posttreatment as a result of the problem-solving module.

Method

Design

This study is part of the STARr-project, a project set up in the Netherlands that focuses on the prevention of clinical depression by means of a group-based intervention program based on CBT. The project is designed as a randomized controlled trial (RCT) with four parallel conditions. In each condition adolescents participated in an intervention program based on CBT, by which each group worked through four modules in a different order. These modules focused on (1) enhancing problem-solving skills, (2) cognitive restructuring, (3) activity scheduling, and (4) relaxation training. Each module consisted of three sessions, coming up to a total of twelve sessions for the intervention program. Assessments were conducted: pretreatment, after the first, second, third and fourth module, and six months after completion of the program. In this study, the outcome of the first modules was considered. Assessments included a pretest measuring the level problem-solving skills and subclinical depressive symptoms pretreatment, and a posttest determining the level of subclinical depressive symptoms. The posttest occurred after one CBT-module was completed, which was after the first three sessions. Figure 1 and 2 give an overview of the research designs applied, including accompanying instruments. The dotted lines represent the significant relationships that were expected.

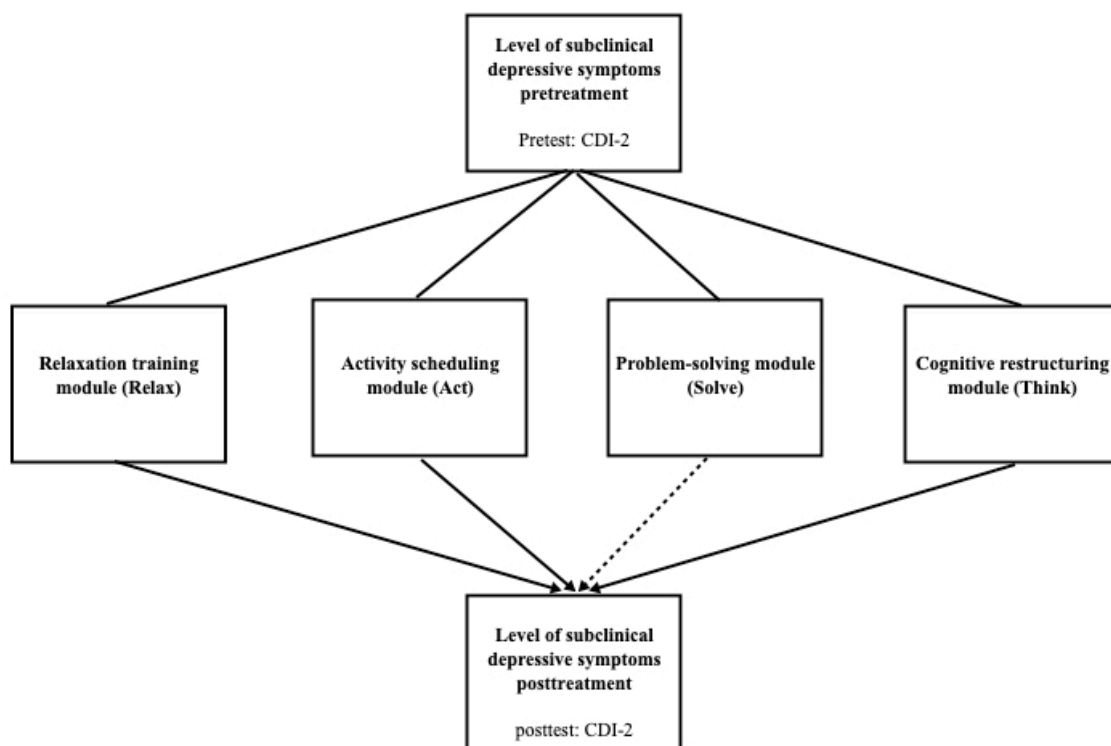


Figure 1. Overview research question 1

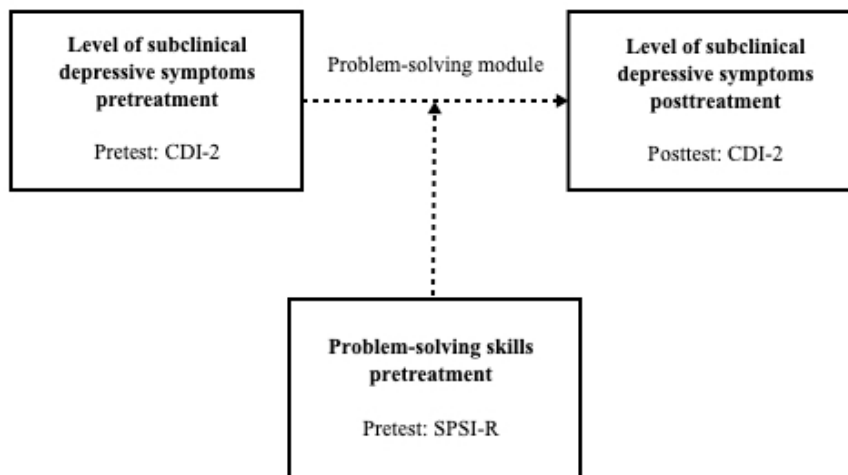


Figure 2. Overview research question 2

Participants

A total of 211 adolescents participated in the intervention program, of which 49 adolescents completed the problem-solving module. Within the total sample, adolescents were between 12 and 18 years of age ($M = 13.93$, $SD = 1.42$). There were 117 girls (55%) and 94 boys (45%). They all attended secondary education. Most had a higher educational level ($n = 148$, 70%), consisting of senior general secondary education or university preparatory education (havo, havo/vwo, vwo/gymnasium in Dutch). The remaining adolescents went to basic preparatory vocational secondary education ($n = 17$, 8%, vmbo-basis/kader/gl in Dutch) or theoretical vocational secondary education ($n = 46$, 22%, vmbo-tl, vmbo-tl/havo in Dutch). Within the sample who completed the problem-solving module, the distribution of age, gender and educational level was rather similar. Adolescents were between 12 and 18 years of age ($M = 14.35$, $SD = 1.51$). There were 28 girls (57%) and 21 boys (43%). Most had a higher educational level ($n = 33$, 67%). The remaining adolescents went to basic preparatory vocational secondary education ($n = 1$, 2%) or theoretical vocational secondary education ($n = 15$, 31%). There was a drop-out rate of approximately 10% across the total sample due to practical reasons, substantial reasons, or because participants did no longer experience depressive symptoms and felt no longer the need to participate in the program.

Adolescents were eligible to participate when (1) they were between 12 and 18 years of age, (2) if their level of education was at least on the level of preparatory vocational secondary education, and (3) if their knowledge of the Dutch language was sufficient. Furthermore, the

adolescents needed to have a percentile of 75 or higher on the Child Depression Inventory 2 (CDI-2; Bodden, Stikkelbroek, & Braet, 2010), which meant that subclinical symptoms of depression disorder were present. Several exclusion-criteria also applied: (1) already receiving CBT for anxiety and/or depression, (2) no permission to participate from parents (this only concerned adolescents below 16 years of age), and (3) a high score, which is a rating of 2, on item 28 of the CDI. Adolescents with a high score on item 28 are more likely to have acute and severe suicidal thoughts or intentions, and probably have a higher need for more intense mental-health services. For this reason, these adolescents were referred to a general practitioner.

Recruitment, screening, randomization

Participants were recruited via a screening at four different high schools located within the region of Utrecht, in the Netherlands. After the schools were informed about the study and gave their permission, adolescents were screened by means of administering the Dutch version of the CDI-2. Adolescents who met the inclusion criteria were invited to participate in the intervention program, based on informed consent. For adolescents under 16 years of age permission from both the adolescent and parents was required. Adolescents above 16 are allowed by Dutch law to give permission themselves. Participating adolescents were then clustered by gender (boy or girl) and age (12-13 years, 14-15 years, 16 years or older), and treatment groups of on average five students from the same school were formed. Subsequently, each treatment group was assigned to one of the four conditions by means of computer-generated numbers. The randomization was not blind for the adolescents, researchers and trainers of the intervention program. This was inevitable, because participating in the intervention program implied knowing which modules were offered and in which order they were completed.

The intervention program

In the overall project, the intervention program contained twelve weekly sessions with each session lasting 45-60 minutes. The program consisted of four modules: Solve, Think, Act and Relax. First, the Solve-module focuses on improving problem-solving skills which included (1) obtaining an overview of the problem, (2) coming up with different solutions, (3) selecting the best suitable solution and (4) evaluating the outcome afterwards (Bell & D’Zurilla, 2009). Second, the Think-module was based on cognitive restructuring. This module dealt with revealing and challenging negative thoughts, and turning these negative thoughts into positive helping thoughts. Third, within the Act-module a variant of activity scheduling was used, focusing on discovering how (a lack of) daily activities of the adolescent influences existing emotions/mood. Finally, the Relax-module learned adolescents how to prevent high levels of

stress and what can be done in order to relax in times of stress. The program was offered by certified professional educationalists or psychologists, whom were recruited via LinkedIn. Beforehand, the professionals received a training which consisted of three days. It is important to emphasize that the first three sessions of the intervention program were the primary focus in this study.

Instruments

The level of subclinical depressive symptoms was measured by means of the Dutch version of the CDI-2. According to the manual of the CDI-2, depressive symptoms are operationalized as follows: negative mood/physical symptoms, negative self-esteem, ineffectiveness and interpersonal problems. The CDI-2 is a self-rate questionnaire that helps assess cognitive, affective and behavioural signs of depression in children and adolescents 7 to 21 years old (Kovacs, 2010). For the current study, the short version of the CDI-2 was administered, which consists of thirteen items primarily focused on questioning the amount and level of depressive symptoms as described by the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5). Each item consists of three statements rated in severity from 0 to 2 (e.g., 'I don't feel alone' = 0, 'I often feel alone' = 1, 'I always feel alone' = 2), with higher scores indicating a higher level of (subclinical) depressive symptoms, as well as more severe symptoms. The minimum overall score is 0. The maximum overall score is 26. Research indicates a good reliability and validity (Bae, 2012; Kovacs, 2010). Cronbach's alpha for the short version of the CDI-2 was .79, indicating a sufficient level of internal consistency.

Next, the *problem-solving skills* pretreatment were measured using the short form of the Social Problem-Solving Inventory-Revised (SPSI-R). This is a self-report measure, initially developed by D'Zurilla (D'Zurilla, Nezu, & Maydeu-Olivares, 2002). It is composed of ten items answered on a 5-point rating scale, ranging from 0 (does not suit me) to 4 (suits me very well), with higher scores indicating a lower level of problem-solving skills. The minimum overall score is 0. The maximum overall score is 40. The SPSI-R measures five problem-solving factors: (1) Positive Problem Orientation, (2) Negative Problem Orientation, (3) Rational Problem-Solving, (4) Impulsivity/Carelessness Style, and (5) Avoidance Style (McGee, Fryer, Bjorkquist, Mattson, & Riley, 2008). Higher domain scores indicate more use of that problem-solving skill, and a higher score indicates better problem-solving skills in general (Visser et al., 2015). The SPSI-R has high internal consistency reliability for both the total score and five scale scores. Cronbach alphas for the five scales ranged from .76 to .92 and test-retest reliability ranged from .72 to .88 (D'Zurilla, Chang, Nottingham, & Faccini, 1998), which also apply to the short form (Dreer et al., 2009). In this study, Cronbach alphas ranged

from .67 to .92, confirming internal consistency.

Procedure

Participants were first addressed for the pretest. This consisted of administering the CDI-2 and the SPSI-R. After completion of the pretest, participants were randomly assigned to four parallel conditions. Within each condition several groups were created, based on the adolescents' age. After completion of the CBT-module, a posttest took place. This repeatedly included completion of the CDI-2.

Analysis

Statistical analyses were performed using IBM SPSS Statistics 25. The data was first screened for missing values. Missing values were coded and dealt with by means of pairwise deletion (Allen & Bennett, 2012). Subsequently, total sum scores of the CDI-2 and SPSI-R were computed. Some items of the CDI-2 and SPSI-R required recoding before valid total sum scores could be calculated. Next, the four conditions were compared on several demographic characteristics using Chi-Square tests for categorical variables (gender and educational level) and a one-way ANOVA for the ratio variable (age at screening). These comparisons were made in order to be able to partial out possible effects of gender, educational level and/or age at screening. Previous research shows that gender and age presumably are significant predictors for the level of depressive symptoms among children and adolescents (Angold & Rutter, 1992). Educational level has been proven to be a significant predictor of depression in a general adult population (Bjelland et al., 2008). Their research indicated that a higher educational level has a protective effect against both depression, which accumulates over time. Analyses showed that gender and age at screening did not significantly differ between each of the four conditions. However, educational level was significantly distributed between the conditions ($\chi^2 = 39.42$, $df = 6$, $p = .000$). For this reason, educational level was included in the analyses as a covariate. Analyses consisted of a one-way analysis of covariance (ANCOVA) to examine the relative effectiveness of a problem-solving module on the level of subclinical depressive symptoms posttreatment. As the level of subclinical depressive symptoms at pre-treatment was expected to impact on this relationship, the total sum score of the CDI-2 at pretest was included in the analysis as a covariate.

Subsequently, a multiple linear regression was conducted to examine whether problem-solving skills pretreatment moderate the relationship between the level of subclinical depressive symptoms pre- and posttreatment, when a problem-solving module is offered. The independent variables were the level of subclinical depressive symptoms pretreatment, problem-solving skills pretreatment, and the interaction between these two variables. The interaction was created

by multiplying both variables together after were centered to a mean of zero. The dependent variable of the regression was the level of subclinical depressive symptoms at posttreatment. The interaction had to be significant for moderation to be supported. An alpha level of .05 was used for all statistical tests.

Results

Relative effectiveness of a problem-solving module

A one-way analysis of covariance (ANCOVA) was used to compare the level of subclinical depressive symptoms at posttreatment among the four conditions. Two covariates were included to partial out the effects of differences in subclinical depressive symptoms pretreatment and the significant difference in educational level. Examination of the Kolmogorov-Smirnov statistics and histograms for each group indicated that the ANCOVA assumption of normality was almost fully supported. The first ($p = .032$) and third condition ($p = .015$) were not equally distributed. Despite these findings, the ANCOVA is considered robust against small to moderate violations of the normality assumption, provided the scores for the covariates alone are normally distributed (Allen & Bennett, 2012). Scatterplots indicated that the relationship between the covariates (the level of subclinical depressive symptoms at pretreatment and educational level) and the dependent variable (the level of subclinical depressive symptoms posttreatment) were linear. Finally, the assumptions of homogeneity of regression slopes and homogeneity of variances were partly supported by significant and non-significant IV-by-covariate interactions, $F(3,152) = 0.32, p = .811$, $F(3, 152) = 3.16, p = .027$ for subclinical depressive symptoms pretreatment and educational level respectively. Despite this, the assumption of homogeneity of variance seemed supported by a non-significant Levene's test $F(3,160) = 1.97, p = .121$

The ANCOVA indicated that, after accounting for the level of subclinical depressive symptoms pretreatment and educational level, there was a non-significant effect of the intervention program on the level of subclinical depressive symptoms posttreatment, $F(3,158) = 0.16, p = .926$, partial $\eta^2 = .003$. Post-hoc testing revealed that adolescents who completed the Solve module reported no different levels of subclinical depressive symptoms than adolescents who completed the Think, Act or Relax module ($p = 1.00$). Likewise, the remaining pairwise comparisons were not significant ($p = 1.00$) The average scores on the CDI-2 for all conditions are reported in Table 1.

Table 1

Average Scores on the CDI-2 Pre- and Posttreatment

	Condition 1 (Think)		Condition 2 (Act)		Condition 3 (Solve)		Condition 4 (Relax)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Total score CDI-2 pretreatment	8.12	3.96	7.94	3.49	8.79	4.07	7.87	4.24
Total score CDI-2 posttreatment	8.32	3.08	7.89	2.85	8.82	3.32	8.31	3.14

Moderation of problem-solving skills

A standard multiple regression analysis (MRA) was performed to estimate the proportion of variance in the level of subclinical depressive symptoms that can be accounted for by problem-solving skills pretreatment. Prior to interpreting the results of the MRA, several assumptions were evaluated. First, stem-and-leaf plots and boxplots indicated that each variable in the regression was normally distributed, and free from univariate outliers. Second, inspection of the normal probability plot of standardized residuals as well as the scatterplot of standardized predicted values indicated that the assumptions of normality, linearity and homoscedasticity of residuals were met. Third, Mahalanobis distance did not exceed the critical χ^2 for $df = 3$ (at $\alpha = .05$) of 16.27 for any cases in the data file, indicating that multivariate outliers were not of concern. Finally, relatively high tolerances for all three predictors in the regression model indicated that multicollinearity would not interfere with the ability to interpret the outcome of the MRA. The regression model shows that the results on the CDI-2 pretreatment accounted for a significant 60.7% of the variability in subclinical depressive symptoms posttreatment, $F(1,38) = 58.78, p < .001, R^2 = .61, \text{adjusted } R^2 = .597$. It seems that adolescents with a higher level of subclinical depressive symptoms pretreatment is associated with a higher level of subclinical depressive symptoms posttreatment ($\beta = .779, t(38) = 7.67, p < .001$). Moreover, the results on the SPSI-R pretreatment accounted for a significant 13.3% of the variability in subclinical depressive symptoms posttreatment, $F(1,37) = 5.66, p = .023, R^2 = .13, \text{adjusted } R^2 = .109$. These results suggest that a higher level of problem-solving skills pretreatment is associated with a lower level of subclinical depressive symptoms posttreatment ($\beta = -.364, t(37) = 2.38, p = .023$).

Besides these main effects of the level of subclinical depressive symptoms pretreatment and the level of problem-solving skills pretreatment, the interaction between these two variables accounted for a significant 61.3% of the variability in subclinical depressive symptoms posttreatment, $F(3,35) = 18.15, p < .001, R^2 = .61, \text{adjusted } R^2 = .575$. This last result indicates a statistically significant moderator effect, suggesting that adolescents with a higher level of problem-solving skills tend to show a lower level of subclinical depressive symptoms after completing a problem-solving module within CBT ($\beta = -.605, t(35) = -4.62, p < .001$).

Discussion

The main purpose of this study was to contribute to the existent prevention literature examining why CBT is effective, and for whom it may be more or less effective (Bennet-Levy, 2003; Garber et al., 2018). Two research questions were formulated to (1) determine the relative effectiveness of a problem-solving module within CBT on the level of subclinical depressive symptoms, compared to modules focusing on cognitive restructuring, activity scheduling and relaxation training, and (2) examine to what extent the level of problem-solving skills pretreatment moderates the relationship between the level of subclinical depressive symptoms pre- and posttreatment, when a problem-solving module is offered.

Relative effectiveness of a problem-solving module

Contrary to the hypothesis, the problem-solving module was not significantly more effective in reducing subclinical depressive symptoms among adolescents than the modules focusing on cognitive restructuring, activity scheduling and relaxation training. The symptoms of adolescents remained practically stable within all conditions. These findings are inconsistent with previous studies assessing the effectiveness of CBT (Clarke et al., 1999; Garber et al., 2018), and with studies supporting the added value of problem-solving skills for depressive symptoms (Hasegawa et al., 2018; Keller et al., 2000; Kennard et al., 2009). However, there is an explanation for these inconsistent findings that is worth mentioning. Unlike many previous studies, this study focused on treatment outcome after completion of one CBT-module, which contained three weekly sessions. Although the intensity and frequency vary, most CBT-based preventive programs consist of at least twelve weekly sessions (Kennard et al., 2009). Results could have been more consistent with previous research had the whole intervention program of the STARr-project, which consisted of twelve weekly sessions, been subject of study. This is why future research is necessary to draw more reliable conclusions about the relative effectiveness of separate CBT-modules.

Moderation of problem-solving skills

Results of a multiple linear regression analysis indicate that the level of adolescents' problem-solving skills pretreatment operates as a moderator on the relationship between the level of subclinical depressive symptoms pre- and posttreatment, when a problem-solving module is offered. Contrary to the hypothesis, adolescents with a higher level of problem-solving skills pretreatment tend to show a lower level of subclinical depressive symptoms after completing a problem-solving module within CBT. There are several possible explanations for the findings of this study. One explanation could be that adolescents with a higher level of problem-solving skills pretreatment were better able to understand the value and mechanisms of the problem-solving skills taught in the problem-solving module, and were therefore better able to apply these skills in everyday situations and in the case of negative stressful life events (Nezu et al., 1986; Spence et al., 2002). Another explanation could be that the adolescents with a higher level of problem-solving skills pretreatment did not benefit from the problem-solving module as expected, because their lower level of subclinical depressive symptoms posttreatment was partly a result of their already higher level of problem-solving skills pretreatment (Cannon et al., 1999; Nezu et al., 1986). It is up to future research to investigate which explanation is the best fit, by taking the level of problem-solving skills pre- and posttreatment into account.

Strengths and limitations

This study is one of the first to examine the contribution of specific CBT-modules separately. Furthermore, this study is the first to consider a moderation effect of problem-solving skills pretreatment among adolescents. Doing so, a carefully composed intervention program was offered by certified professionals. Nevertheless, some limitations should be considered in the interpretation of the results. First, the sample was less representative due to the limited amount of schools selected. The sample selected for the second research question was fairly small. Second, results would have been more valid and reliable if a (wait list) control group had been part of the study. This way the likelihood that the effects of the intervention program occurred due to factors outside of the experimental treatment could have been further reduced.

Conclusion and clinical implications

Despite the mentioned limitations, this study contributes to scientific knowledge by showing that the relative effectiveness of a problem-solving module within CBT is not significantly higher compared to modules focusing on cognitive restructuring, activity scheduling and relaxation training. These results apply to a relatively short intervention program, used for the

prevention of subclinical depressive symptoms among adolescents. Furthermore, the level of subclinical depressive symptoms after a problem-solving module is likely moderated by problem-solving skills pretreatment. These findings are important for clinical practice. A focus on changing the overall problem-solving orientation, including accompanying problem-solving techniques, may reduce subclinical depressive symptoms.

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