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ORIGINAL ARTICLE

Training Adaptive Emotion Regulation Skills in Early Adolescents: The Effects of Distraction, Acceptance, Cognitive Reappraisal, and Problem Solving

Brenda Volkaert[1] · **Laura Wante**[1] · **Marie-Lotte Van Beveren**[1] · **Leentje Vervoort**[1] · **Caroline Braet**[1]

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Abstract

Adolescence is a critical developmental period in which intense experienced negative emotions need to be successfully regulated in order to decrease the risk of developing psychopathology. This study investigated the immediate and prolonged effects of training emotion regulation (ER) in 256 young adolescents (9–13 years). The four experimental conditions in which an ER skill (acceptance, distraction, cognitive reappraisal, and problem solving) was trained were compared with two control conditions (rumination, performing a cognitive task). Results revealed that: (1) happy affect significantly increased and sad and anxious affect significantly decreased in the four experimental ER conditions but also in the cognitive task condition. Rumination did not have beneficial ER effects. (2) In the experimental condition, the effects on sad and happy affect were more prominent after using distraction, problem solving, and cognitive reappraisal compared to using acceptance. (3) There were no long-term effects of the ER training (ERT) at 1-month follow-up. These results demonstrate that young adolescents are able to use distraction, acceptance, cognitive reappraisal and problem solving, but that the effects of those strategies do not outperform the effects of a neutral cognitive task. In addition, our findings confirm that rumination leads to the maintenance and increase of negative affect, at least short-term. Further research should explore the effects of a more extensive ERT on intense affect states in young adolescents and should investigate the supplementary effects of such a program compared to a neutral cognitive distraction task.

Keywords Emotion regulation · Adolescence · Distraction · Acceptance · Cognitive reappraisal · Problem solving

Background

Young adolescents face a wide range of biological, social, and psychological changes (Calkins 2010; Inchley et al. 2016), which activate stress and intense emotions that need to be managed and regulated (Heller and Casey 2016; Steinberg 2005). Moreover, as young adolescents are still maturing emotionally and cognitively, they often fail to deal with these emotions adequately and are at higher risk of developing psychopathology (Silk et al. 2003; Steinberg 2005). Adolescent psychopathology is of great concern given its prevalence among young adolescents (i.e., 12 to 15 years) (Costello et al. 2011). Approximately 5 to 20% of adolescents worldwide experience psychological problems, and 50–70% of adolescents suffering from psychopathology fail to find adequate treatment (Copeland et al. 2009; Coppens et al. 2015; Costello et al. 2011; De Girolamo et al. 2012). These findings suggest that prevention programs targeting this vulnerable group are highly indicated. However,

✉ Brenda Volkaert
Brenda.Volkaert@ugent.be

Laura Wante
Laura.Wante@Ugent.be

Marie-Lotte Van Beveren
Marielotte.vanbeveren@ugent.be

Leentje Vervoort
Leentje.Vervoort@Ugent.be

Caroline Braet
Caroline.Braet@ugent.be

[1] Department of Developmental, Personality and Social Psychology, Ghent University, Henri Dunantlaan 2, 9000 Ghent, Belgium

prevention programs so far have often shown low to no effects on reducing the risk for psychopathology (Durlak et al. 2011). Therefore, the present study aims to evaluate the training of new prevention techniques embedded in the emerging field of emotion regulation (ER) for targeting adolescent psychopathology.

In adults, programs focusing on transdiagnostic mechanisms, such as the ER training (ERT) of Berking and Lukas (2015), seem to have promising effects for both intervention and prevention purposes. For example, Buruck et al. (2016) evaluated a prevention program for improving ER skills and well-being of employees in elderly health care. Results revealed that, in comparison to the control-group, the ERT-group reported a significant improvement in ER skills from pre to posttreatment, which was related to greater well-being at 6 months follow-up. Furthermore, growing research highlights the transdiagnostic role of ER in the development and maintenance of adolescent psychopathology such as depression (Abravanel and Sinha 2015; Campbell-Sills and Barlow 2007; Mennin et al. 2007), anxiety disorders (Abravanel and Sinha 2015; Essau et al. 2017; Mennin et al. 2007), aggressive behavior (Herts et al. 2012), substance use problems (Wills et al. 2011), and eating pathology (Dingemans et al. 2017; Haedt-Matt and Keel 2015).

ER can be defined as the "processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions" (Gross 1998, 2013). In addition, the concept of ER is used to refer to the processes for strengthening, reducing, as well as controlling or maintaining both positive and negative emotions (Denham 1998; Gross 2013; Tugade and Fredrickson 2007). Affect regulation models consider ER as an umbrella term that consists of several components (ER skills) whereby emotional awareness, acceptance, and ER strategies are considered to be important skills to effectively regulate one's emotions (e.g. Berking and Whitley 2013; Lord et al. 2002). *Emotional awareness* refers to the skill of an individual to identify, explain, and discern his or her own as well as others' emotional experiences (Lane and Schwartz 1987) which is needed for the effective use of ER strategies (Aldao et al. 2010; Lambie and Marcel 2002; McRae et al. 2011, 2012). *Acceptance* (*ACC*) can be defined as an ER skill that stimulates the individual to experience the emotional situation as well as associated thoughts and emotions to the fullest without trying to avoid, control, or change anything, which in turn decreases the urge to engage in automatic fight or flight responses (Hayes et al. 1999, 1996). Rood et al. (2012) investigated the impact of experimentally-induced acceptance among adolescents. Results showed that the use of instructed acceptance was not superior to the instructed use of rumination in adolescents age 13 to 18. Nevertheless, other studies demonstrated the effectiveness of acceptance as a valuable component of promising prevention programs (Biglan et al. 2008; Burckhardt et al. 2016; Raes et al. 2014). *ER strategies* can be conceptualized as the processes by which an individual actively modifies his or her own emotions (Aldao et al. 2015; Gross 1998; Koole 2009) and are considered to be adaptive or maladaptive based on their overall effects on emotion, cognition, and behavior and their association with psychopathology (Aldao et al. 2010, 2015; Cracco et al. 2017; Schäfer et al. 2016; Tull and Aldao 2015). Furthermore, when studying the effects of ER strategies on emotional wellbeing, it is important to consider the extent to which these strategies are applied flexibly. Flexible ER refers to the ability of the individual to select (and apply) different ER strategies from one's personal ER repertory in different situations depending on the contextual demands and one's personal goals (Kobylinska and Kusev 2019).

ER strategies are considered to be *adaptive* or protective in the development of psychopathology if they successfully reduce negative affective states, strengthen or control positive affective states, and restore emotional balance (Aldao et al. 2010; Gross 2013). Furthermore, research indicates that especially the flexible use of adaptive ER strategies fosters psychological wellbeing (Aldao and Nolen-Hoeksema 2012). Examples of the so-called adaptive ER strategies are distraction, cognitive reappraisal, and problem solving. *Distraction* (*DIS*) can be conceptualized as "intentionally shifting attention away from the emotion to an external stimulus in order to reduce negative self-thoughts and self-criticism" (Gross 1998). As a stand-alone strategy, DIS has proven its merit. Hilt and Pollak (2012) for example showed that brief DIS instructions are more effective in getting young adolescents out of a ruminative state, compared to rumination or problem-solving instructions. However, Wolgast and Lundh (2017) concluded that distraction also can be considered ad maladaptive if combined with an attitude of avoidance. Furthermore, results on the long-term effects of DIS in adolescents are practically non-existing and further research is needed to clarify the exact role of this strategy for emotional wellbeing. *Cognitive reappraisal* (*CR*) can be explained as thinking in a more positive way about an emotional stimulus or event (Gross 1998). The use of this specific ER strategy has repeatedly and consistently shown to be effective in decreasing adolescents' negative mood (McRae et al. 2012; Picó-Pérez et al. 2017; Rood et al. 2012) particularly when the level of arousal and the intensity of negative emotions are mild to moderate (McRae et al. 2011). Finally, *problem solving* (*PS*) can be defined as actively modifying the stressors that induce negative affect in order to change the associated emotions (D'Zurilla and Nezu 1999; Nezu and D'Zurilla 2006). Despite the fact that PS is a frequently used component in CBT programs, studies that evaluate the explicit effects of PS as a stand-alone ER strategy in adolescents are relatively scarce. In one study, Hilt and Pollak (2012) examined the effects of instructed PS on adolescents'

induced ruminative state but did not find a beneficial effect compared to mindfulness and distraction.

ER strategies are considered as *maladaptive* or a risk factor for the development of psychopathology if they only provide short term relief, are unsuccessful in strengthening and maintaining positive affect states, and fail to reduce negative affect (Aldao et al. 2010). Furthermore, these ER strategies are often selected out of the ER repertory without taking into account the contextual demands or one's personal goals (Aldao and Nolen-Hoeksema 2012). *Rumination (RUM)* is one of the most well studied so-called 'maladaptive' ER strategies (Nolen-Hoeksema et al. 2008) and can be defined as repetitively and passively thinking about negative emotions, their causes and consequences. Both the widely-cited reviews of Aldao et al. (2010) and Schäfer et al. (2016) indicate that the use of RUM as an ER strategy predicts symptoms of a wide range of psychopathology (i.e., depression, anxiety, substance abuse, and eating disorder symptoms) as well as the onset and recurrence of full-blown psychological disorders such as major depressive disorder and bulimia nervosa in children, adolescents, and adults alike.

Adolescence is a critical developmental phase for the development of ER. Research indicates that there are different developmental courses of the reactive and regulative brain systems (Somerville et al. 2010), which are both crucial for the successful adoption of ER strategies in young adolescents (Riediger and Klipker 2014). More specifically, an oversensitive activation of the reactive brain system, as well as a slower activation of the regulative brain system when confronted with emotional stimuli seems to challenge the successful use of ER strategies (Crone and Dahl 2012; Somerville et al. 2010; Steinberg 2005). Not surprisingly, research has shown that particularly between the ages of 12 and 15 years less adaptive—as well as more maladaptive ER strategies are observed in comparison to other age groups (Cracco et al. 2017). Training adaptive ER skills may thus be critical in this specific age group (Schäfer et al. 2016).

To conclude, adolescence can be considered as a stressful transition phase as it is characterized by important changes in ER and an increased risk for developing psychopathology. Setting up and evaluating prevention programs targeted at improving adaptive ER skills in the transition phase between childhood and adolescence appears to be an important avenue for future research. Of note is that children should have a minimum age of nine years old to participate in such ER prevention programs as they appear to have sufficient cognitive and emotional abilities to independently use cognitive ER strategies from that age on (Harris 1989; Meerum and Stegge 1995; Saarni 1999).

Nevertheless, little research has investigated whether and under which conditions young adolescents can be trained and stimulated to effectively use adaptive ER skills. Interestingly, a study of Wante et al. (2017) investigated the differential effects of ACC, DIS, and CR, and compared their effects with those of RUM in youth aged 10 to 13 years. Results showed that young adolescents were able to use the aforementioned adaptive ER skills if instructed and that using these ER skills after a negative mood-induction sorted promising and immediate effects on their self-reported positive and negative affective states. However, several limitations of this study jeopardize these results. First, the study did not include a neutral control group making it difficult to fully capture the specific effects of these ER skills. Second, PS was not included in this study despite the fact that this ER strategy has repeatedly proven its effectivity in successfully regulating negative emotions (Hilt and Pollak 2012). Third, besides the immediate effects of training these ER skills, the long-term effects of the ER instructions were not evaluated. Finally, following from their results, Wante and colleagues (2017) also hypothesized that the found effects could be intensified by instructing the participants to apply emotional awareness before adopting the instructed ER strategy—a proposition that has not been subjected to scrutiny thus far.

Goals and Hypothesis

The current experimental study had three main goals. First, this study aimed to examine the short-term effects of training emotional awareness and specific adaptive ER skills (i.e., ACC, DIS, CR, or PS) on young adolescents' ability to regulate their affective states after a standardized mood-induction. Based on previous research on the effects of instructed ER strategies (De Witte et al. 2017; Hilt and Pollak 2012; Rood et al. 2012; Wante et al. 2018), it was hypothesized that adolescents who are trained and stimulated to be aware of their own feelings and to use one of the four specific adaptive ER skills are better at upregulating positive (i.e., happiness) and downregulating negative affect (sadness, anxiety, and angriness) after a negative mood-induction compared to adolescents who are stimulated to ruminate (control condition 1) or to perform a cognitive task (control condition 2). Second, this study aimed to explore the sustained effects of such a training on the level of emotional awareness, the use of adaptive and maladaptive ER strategies, depressive symptoms, and stress symptoms at 1-month follow-up. Since research has already suggested an association between emotional awareness, the use of ER strategies and psychopathology symptoms (Van Beveren et al. 2018), it was hypothesized that young adolescents who are trained and stimulated to be aware of their emotions and to use one of the four specific adaptive ER skills report less problems with emotional awareness, a higher general use of adaptive ER strategies, a lower use of maladaptive ER strategies and less depressive- and stress symptoms after 1-month follow-up compared to adolescents who are stimulated to ruminate (control condition 1) or to perform a cognitive task (control

condition 2). Third, current study aimed to explore the differential immediate and sustained effects of the trained ER skills. Considering that previous research found most promising immediate results of instructing DIS and CR (De Witte et al. 2017; Hilt and Pollak 2012; Rood et al. 2012; Wante et al. 2017), it was hypothesized that the DIS training will show the strongest results, followed by the CR training. Furthermore, previous research indicates that instructed ACC is not more effective than instructed RUM (Rood et al. 2012), and PS is less effective in comparison to ACC and DIS (Hilt and Pollak 2012). Therefore, it was hypothesized that ACC and PS will have lower effects in comparison to DIS and CR.

Method

Participants

The sample consisted of 256 young adolescents (49% boys) recruited from 24 classes distributed among 7 primary schools in Flanders. Each of the 24 classes was randomly assigned to 1 of the 4 experimental (ERT) conditions [i.e., *ACC* ($n=51$), *DIS* ($n=43$), *CR* ($n=39$), and *PS* ($n=40$)] or 1 of the 2 control conditions [i.e., *RUM* ($n=44$) and *TASK* ($n=39$)]. Participants were 9 (*1%*), 10 (*36%*), 11 (*49%*), 12 (*12%*), or 13 (*2%*) years old (M = 10,77, SD = 0.72) and attended the fifth ($n=156$) or sixth ($n=105$) grade of primary school. Data of five participants (2%) were excluded given their absence during the day of the experimental phase at school. A priori power analysis showed that 40 young adolescents in each condition were needed to detect effect sizes $f \geq 0.10$ with a significance level of $\alpha = 0.05$ and a power level of $\beta = 0.80$.

Measurements

Affect States

Visual Analogue Scales (VAS) were used to assess adolescents' positive and negative emotions. Throughout the ERT, participants were asked four times to report to which degree they were experiencing four feelings i.e., *happy*, *sad*, *anxious*, and *angry* on a scale from 1 ('not at all') to 100 ('a lot') (Wante et al. 2017).

Lack of Emotional Awareness

Problems with emotional awareness were measured with a subscale of the Dutch version of the Difficulties in Emotion Regulation Scale (DERS). The DERS is a 36-item self-report questionnaire developed to assess individuals' identification, understanding, and modulation of their own emotions (Gratz and Roemer 2004; Neumann et al. 2010) and consists of 6 dimensions of problems with ER (i.e., Non-acceptance, Goals, Impulse, Strategies, Clarity, and Lack of Awareness). Only the subscale 'Lack of Awareness' was administered in the current study, reflecting the reluctance to become aware, to attend, and to acknowledge one's own emotions (e.g. "I pay attention to how I feel"). Participants were asked to score six statements on a scale from 1 ('almost never) to 5 ('almost always'). All item scores were reversed, whereby higher total scores indicate a higher lack of emotional awareness. The DERS has demonstrated good validity and reliability for all subscales in adolescent populations (Neumann et al. 2010). In the current study, the subscale showed a Cronbach's α coefficient of 0.74, indicating a good level of internal consistency.

Emotion Regulation Strategies

Adolescents' ER strategies were assessed using the 90-item Dutch version of the Fragebogen zur Erhebung der Emotionsregulation bei Kindern und Jugendlichen (FEEL-KJ) (Braet et al. 2013). This self-report questionnaire includes 15 ER strategies that can be allocated to one of three categories based on their association with overall psychopathology i.e., 'adaptive', 'maladaptive', or 'external'. Adolescents indicate on a 5-point Likert scale ranging from 1 ("almost never to") to 5 ("almost always") how often they use a specific adaptive (*behavioral problem-solving*, *distraction*, *reappraisal*, *acceptance*, *forgetting*, *cognitive problem-solving* and *cognitive reappraisal*), maladaptive (*giving up*, *aggression*, *withdrawal*, *self-devaluation*, and *rumination*), and external (*social support*, *expression*, and *emotional control*) ER strategy in response to feelings of anger, sadness, and fear (e.g. "When I am angry, I try to change what makes me feel angry"). In addition to the scores on the specific ER strategies, total scale scores for adaptive, maladaptive and external ER strategies can be calculated indicating one's overall disposition to use adaptive, maladaptive ER, and external ER strategies. Since the total score on the 'adaptive ER strategies' subscale represents the repertoire of adaptive ER strategies that one has at his/her disposal, it can be considered as a rough measure of ER flexibility. The total score on maladaptive ER strategies, however, represents one's general ER dysfunction (Wante et al. 2016). For Flemish youth, a lack of adaptive ER strategies is indicated by a total raw score below 112 for girls and below 113 for boys (T score of 40). A dysfunctional use of maladaptive ER strategies is indicated by a total raw score higher than 96 for girls and higher than 84 for boys (T score of 60). The FEEL-KJ has demonstrated good psychometric properties (Braet et al. 2013; Cracco et al. 2015). In the current study, only the overall scores on adaptive (Cronbach's $\alpha = 0.90$) and maladaptive ER strategies (Cronbach's $\alpha = 0.78$) were used.

Symptoms of Depression

Depressive symptoms were measured with the Dutch version of the Child Depression Inventory (CDI; Kovacs 1982; Timbremont and Braet 2002) which consists of 27 items. Each item consists of three statements that vary in severity (e.g. 'I feel like crying everyday', 'I often want to cry', 'I sometimes feel like crying') and adolescents select the statement that best describes his or her feelings in the past two weeks. A score can be assigned to each statement, ranging from 0 to 2 (Kovacs 1982). The total score gives an indication of the severity of the self-reported depressive symptoms. A total score that is equal to—or higher than 16 indicates a clinical level of depressive symptoms (Timbremont and Braet 2002). The CDI has demonstrated satisfactory psychometric properties in previous research (Kovacs 1982; Timbremont and Braet 2002) and shows good internal consistency in the current study with Cronbach's $\alpha = 0.88$.

Stress Symptoms

Perceived stress was assessed with the Dutch version of the Perceived Stress Scale (PSS; Cohen et al. 1983). This 10 item self-report questionnaire measures the individual perception of stress which is conceptualized as the degree to which life situations are appraised as stressful by the individual. The PSS thus assesses the individual's perception of the discrepancies between the environmental requirements and one's ability to meet these requirements (i.e., secondary cognitive reappraisal) (Cohen et al. 1995; Kemeny 2003). Adolescents are asked to indicate on a 5-point Likert scale, ranging from 0 ("Never") to 4 ("Very often") the frequency of feelings and thoughts associated with situations that occurred in the last month (e.g., "How often do you feel like you could handle your personal problems"). The higher the total score is, the more perceived stress is reported. Scores ranging from 0 to 13 refer to low stress-levels, scores ranging from 14 to 26 to moderate stress, and scores ranging from 27 to 40 refer to high perceived stress. Although the PSS does serve as an objective measure of stress, previous studies show promising associations between self-reported stress and physiological correlates of stress such as muscle tension, heart rate variability, and cortisol production (Michels et al. 2013; Wijsman et al. 2010). Furthermore, the PSS has shown good psychometric properties (Cohen et al. 1983). In the current study, the Cronbach's α was 0.66, which can be interpreted as questionable.

Procedure

Seven primary schools in Flanders agreed on participating in the current study and informed the teachers of all classes in fifth and sixth grade about the study. Consequently, all pupils of the participating classes and their parents received an information letter about the objectives and the procedure of the study and were asked to give or withhold consent for participation in the study. Next, classes were randomly assigned to one of the six conditions. Adolescents in the *ER* conditions (i.e., ACC condition, DIS condition, CR condition, and PS condition) were asked to fill out four online questionnaires about problems with emotional awareness, ER strategies, depressive and stress symptoms 1 week before (T0) and 1 month after (T5) participating in the ER skill training. Adolescents assigned to the *control* conditions (i.e., RUM condition and TASK condition) filled out the online questionnaires simultaneously at T0 and T5 but did not receive any ERT.

The study took place at school during standard school hours. Each class was divided into 2 groups consisting of 9 to 16 pupils and there was 1 trainer per subgroup. Trainers were clinical psychologists with at least a bachelor's degree. Before the start of the ERT, participants received a short psychoeducation session about the basic emotions which provided them with sufficient knowledge needed to reliably fill out the VAS. The study lasted for about 125 min and consisted of four phases (see Fig. 1 for an overview).

In the *first phase* (80 min), adolescents in the ER conditions took part in *a classroom ERT*. The ERT consisted of three parts (3×15 min) which were identical in each experimental condition and a fourth part of 35 min, which was specific to each experimental condition (ACC, DIS, PS, or CR): (1) Part 1 included a short introduction aimed at familiarizing the young adolescents with the trainers. (2) In Part 2, participants received information on the cognitive triangle, i.e., associations between feelings, thoughts, and behavior. (3) Part 3 was dedicated to teaching adolescents emotional awareness and included a breathing exercise which may help to cope with the increased levels of arousal when experiencing intense negative affect (Hofmann 2015) and has proven helpful in labeling one's own emotions. (4) In the fourth part of the ERT, adolescents learned and practiced the *specific* competencies needed for the successful use of a specific adaptive ER skill (ACC, DIS, PS, or CR). In this part of the training, adolescents were provided with real-life examples and a written step-by-step plan. In the ACC condition, participants practiced how to become aware of their own feelings, without judging them. Furthermore, they took part in a classical game in which they learned about the different functions of emotions (e.g., "Anxiety alerts us towards cues in the environment which may be harmful or dangerous. It helps us to interpret potential threats and react immediately") in order to facilitate the acceptance of intensive negative emotions. In the DIS condition, participants were informed about distractive activities as a mean to internally shift attention away from the emotional situation in order to actively regulate negative emotions. A group brainstorm session

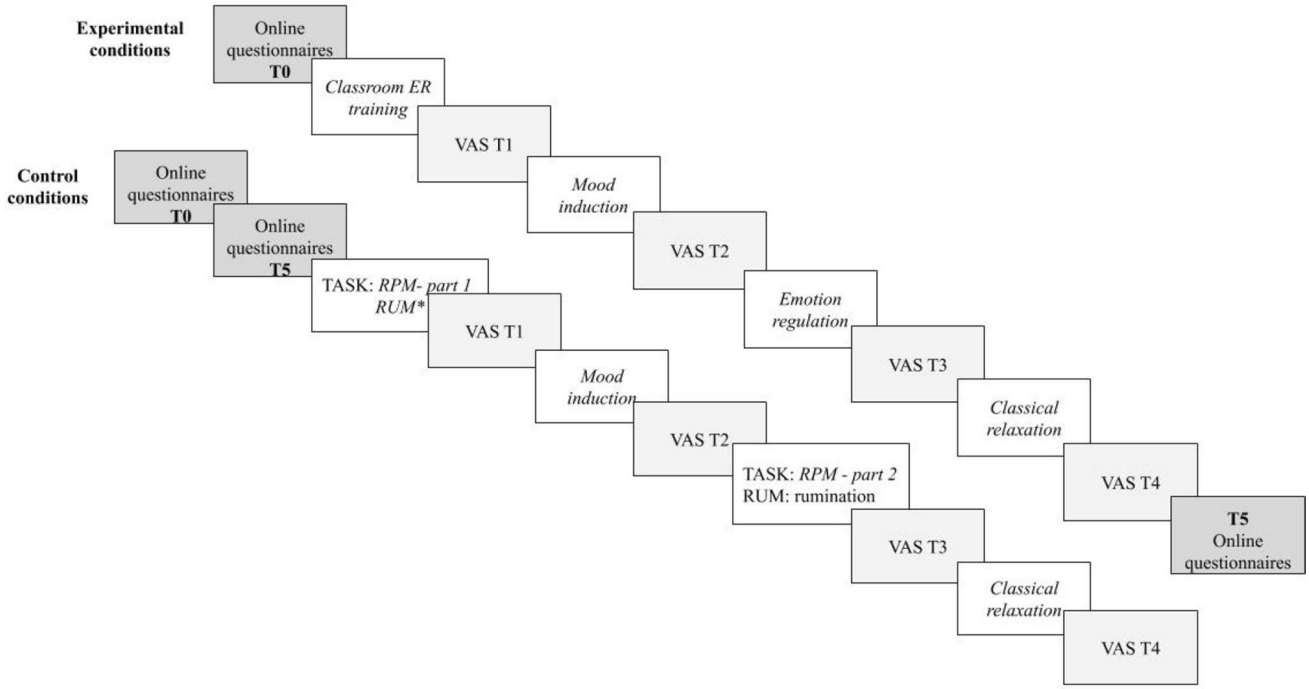

Fig. 1 Schematic overview of the experimental design of the experimental conditions (DIS, ACC, CR, and PS) and the control conditions (TASK and RUM). Note *participants in the RUM condition were in this phase told that they will receive instructions after the next phase (i.e mood induction phase)

was conducted to identify effective distraction activities. In the CR condition, participants learned how to become aware of their own thoughts and practiced generating helpful and more positive thoughts through role-play. In the PS condition, the different steps to solve an emotional problem were introduced to the participants, including recognizing and understanding the problem, generating limitless solutions, considering important preconditions when choosing the best solution, effectively accomplishing the chosen solution, and evaluating the solution. The content of each ER skill training was based on evidence-based protocols, some of which originally designed for adults. These were adopted so that they would be suitable for use in children and adolescents (Berking and Lukas 2015; Bögels 2008; Braet and Stark 2011; Dewulf 2012; Gundrum 2010; Southam-Gerow 2013; Utens 2003). Participants in the control conditions (i.e., TASK and RUM condition) did not receive any ERT. Instead, participants in the TASK condition were instructed to engage in the Raven's Progressive Matrices (RPM) task (Raven 1938). The RPM is a 60-item nonverbal group task to measure cognitive skills. With each item, the child is asked to identify the missing piece in a complex visual geometric design. Participants in the RUM condition were told that they would receive instructions after phase two. To account for the difference in the amount of personal contact with the trainers between the experimental and control conditions, participants in the control conditions were given more time to talk about emotions and familiarize themselves with the trainers than the experimental group, so that each group spent the same amount of time with the trainers (i.e., approx. 80 min).

In the *second* 'mood-induction' *phase* (15 min), participants were presented with a validated film clip "Father and Daughter" of Michaël Dudok de Wit, which thematizes grief and loss, to induce *negative mood*. In this film, a father says goodbye to his daughter and leaves by boat. As the child grows up, she keeps returning to the place where her father left her, longing for him to return. Throughout the film she becomes a young woman and starts a family. At the end, she has become old and the river where her father left her has run dry. Nonetheless, she keeps searching for him until she eventually dies (Wante et al. 2017).

In the *third phase* (15 min), participants in the *experimental conditions* were asked to regulate their induced negative mood by using the ER skills that they were taught in the training session and were stimulated to use the written step-by-step plan. Participants in the *control conditions* received different instructions. In the TASK group, participants were instructed to continue completing the cognitive task (i.e., RPM) after being interrupted to watch the film clip. In the RUM group, the use of a maladaptive ER strategy, namely rumination, was induced. Adolescents were stimulated to think about questions such as "How long will and can this feeling last?" or "When did you felt something similar?

What happened?" and were instructed to write down their answers.

In the *fourth phase* (15 min), participants joined a group *relaxation session* to ensure that all adolescents' affective states approached baseline levels by the end of the study.

Adolescents' positive (i.e., *happy*) and negative (i.e., *sad*, *anxious* and *angry*) affective states were assessed four times during the study; at the beginning of the study (baseline, T1), after the mood-induction (T2), after the use of an ER skills or control task (T3), and after the relaxation session (T4). A schematic overview is presented in Fig. 1.

Data Analysis

Preliminary analyses of the data suggested that the percentage of missing data ranged between 0 and 8% per item. Comparison of means and covariances of all variables using Little (1988) MCAR test produced a normed χ^2 (χ^2/df) of 0.91, $p > 0.30$, indicating that the data were likely to be missing completely at random (Bollen 2014). Consequently, missing item values were imputed following the expectation maximization (EM) algorithm available in SPSS 24 (Schafer 1997).

Due to the clustered nature of the data [i.e., time-points (level 1) are nested within individuals (level 2), that are nested within classes (level 3)], the responses of the children attending one class may be more likely to be similar compared to children from a different class. Therefore, it was checked if multilevel modeling would be a more designated way of analyzing the change in the outcome measures Analyses were conducted using multilevel modeling with MLwiN Version 2.36. In the multilevel models, variance was first estimated for each dependent variable at the class level together with the intraclass correlations (ICCs), i.e., the proportion of variance the class-level explains of the total variance as indicators of variation among schools. At the class level, the ICC values were 0.05, 0.08, 0.03, and 0 for anxious, sad, happy, and angry affect respectively with all variances being non-significant i.e., $\chi^2_{scared}(1) = 2.38, p = 0.12$; $\chi^2_{sad}(1) = 3.83,\ p = 0.05;\ \chi^2_{happy}(1) = 1.36,\ p = 0.244$; $\chi^2_{angry}(1) = .00, p < 0.001$. Based on these results, it was concluded that class should not be included in the analyses. Units of analyses are individuals.

Baseline characteristics were analyzed using Multivariate Analysis of Variance (MANOVA) with *condition* (ACC, DIS, CR, PS, TASK, RUM) as the independent variable and lack of *emotional awareness* (DERS), the use of *ER strategies* (FEEL-KJ), *depressive symptoms* (CDI), *stress symptoms* (PSS), and the four *affective states* (happy, sad, anxious, and angry) reported at baseline assessment, as dependent variables. Further, as ER is rapidly developing in early adolescence (Somerville et al. 2010), it was explored whether the use of adaptive and maladaptive ER strategies varied across age groups in our sample and whether age had a significant impact on the outcome variables to determine whether it should be included as a covariate of no interest.

To examine the experimental effects of the mood-induction (T2), the ER skill (T3) and the relaxation exercise (T4), Repeated Measures Analysis Of Covariances (RM-ANCOVA) were used. Although the study hypotheses are valence-specific (positive vs. negative), analyses were run separately for each emotion. This is based on prior research indicating that sadness, angriness, and anxiousness differ on the level of arousal they elicit and thus are worth exploring separately (Lench et al. 2011; Schwartz et al. 1976). A RM-ANCOVA for each affect (happy, sad, angry, and anxious) was computed with *time* (T1, T2, T3, T4) as a within factor, *condition* (ACC, DIS, CR, PS, TASK, RUM) as a between factor, and *baseline affect* (happy, sad, angry and anxious) as covariates. If multivariate tests showed a significant interaction effect, Test of Within-Subjects Effects and Test of Between-Subjects Effect were used to examine the main effects. Mauchly's Test was overall significant, indicating that the assumption of Sphericity was violated. Therefore, degrees of freedom were adapted using Greenhouse–Geisser. Furthermore, contrasts and pairwise comparisons were used to examine the effects of the time points for each condition. In addition, a MANCOVA with *condition* as an independent variable (ACC, DIS, CR, PS, TASK, RUM), *change score* as dependent variable (the score on T3 distracted with the score on T2 for each affect) and *baseline affect scores* as covariates (VAS), were used to examine the differential effects of *ER skills* on affective states. Pillai's Trace was interpreted, even if Equality of Covariance Matrices were indicating that the observed covariance matrices of the dependent variables were not equal across groups. Since group sizes were over 30, the MANCOVA was robust to violations of assumptions (Allen and Bennett 2008). For pairwise comparisons between conditions, the post hoc test LSD or Games–Howell were used, depending on whether Levene's Test of Equality of Error variances was significant or not.

To examine the effect of adaptive *ER after 1-month follow-up*, a RM-ANOVA was computed for each follow-up variable (*lack of emotional awareness*, *the use of ER strategies*, *depressive- and stress symptoms*), with *time* (T0, T5) as a within factor and *condition* as a between factor (ACC, DIS, CR, PS, TASK, RUM). Since there were only two levels of repeated measures (T0, T5), there was no need to conduct Mauchly's Test and Sphericity could be assumed.

Results

Descriptives

An overview of mean scores (*M*) and standard deviations (*SDs*) of each dependent variable for each condition can be

found in Table 1. On average, participants showed a sufficient use of adaptive ER strategies and no dysfunctional use of maladaptive ER strategies (FEEL-KJ). Furthermore, average scores did not show clinically significant levels of depressive symptoms (CDI) or perceived stress (PSS). Pillai's trace showed significant baseline differences between the six conditions, $F(45, 1205) = 1.52$, $p = 0.016$, $\eta_p^2 = 0.504$. More specifically, univariate analyses demonstrated significant differences in baseline anxiety scores (on VAS) between the TASK condition compared to the PS, DIS and RUM conditions, $F(5, 507) = 3, 966$, $p = 0.002$, $\eta_p^2 = 0.075$. Furthermore, there were no significant baseline differences between conditions for the lack of emotional awareness, $F(5, 27) = 1.171$, $p = 0.324$, $\eta_p^2 = 0.032$, use of adaptive ER strategies, $F(5, 818) = 0.838$, $p = 0.524$, $\eta_p^2 = 0.017$, use of maladaptive ER strategies, $F(5, 53) = 0.253$, $p = 0.839$, $\eta_p^2 = 0.005$, depressive symptoms, $F(5, 95) = 1.800$, $p = 0.113$, $\eta_p^2 = 0.035$, stress symptoms, $F(5, 32) = 0.981$, $p = 0.430$, $\eta_p^2 = 0.020$, angry affect, $F(5, 129) = 1.168$, $p = 0.325$, $\eta_p^2 = 0.098$, sadness, $F(5, 429) = 1.918$, $p = 0.092$, $\eta_p^2 = 0.140$, and happiness, $F(5, 1105) = 2.056$, $p = 0.072$, $\eta_p^2 = 0.040$.

Age-related analyses revealed that variances of scores on adaptive ($p = 0.544$) and maladaptive ER strategies

Table 1 Mean scores and standard deviations of each dependent variable for each condition on each timepoint

	PS	DIS	ACC	CR	TASK	RUM
N	40	43	51	39	39	44
Sex (female/male)	(21/19)	(21/22)	(27/24)	(19/20)	(21/18)	(17/27)
Age	10.81 (.59)	10.82 (.82)	10.70 (.64)	10.75 (.11)	10.93 (.72)	10.63 (.71)
T0 EA	17.49 (4.95)	18.00 (4.7)	17.96 (4.19)	19.18 (4.99)	17.13 (4.33)	19.07 (5.79)
T0 AER	141.41 (29.32)	131.00 (30.01)	131.39 (27.34)	133.23 (33.73)	128.86 (33.43)	129.84 (34.01)
T0 MAER	72.20 (10.80)	73.26 (16.20)	72.44 (13.00)	72.16 (16.48)	74.79 (14.31)	71.50 (16.00)
T0 DS	7.43 (4.68)	9.65 (5.92)	9.50 (7.64)	8.89 (6.73)	10.47 (7.17)	12.03 (10.13)
T0 SS	19.17 (5.00)	19.62 (5.42)	19.40 (4.91)	18.25 (4.71)	17.41 (6.22)	17.98 (7.82)
T1 Anxiety	2.79 (6.83)	2.38 (7.89)	4.92 (9.33)	4.28 (8.12)	11.37 (22.6)	1.48 (3.86)
T1 Angriness	1.85 (8.13)	2.66 (6.96)	3.68 (11.50)	1.67 (5.45)	4.41 (6.42)	6.38 (18.20)
T1 Sadness	2.90 (10.172)	3.37 (12.01)	7.53 (14.31)	3.08 (7.59)	10.14 (20.58)	8.93 (20.15)
T1 Happiness	84.99 (17.92)	82.22 (23.01)	79.38 (22.50)	87.82 (17.87)	72.37 (30.66)	80.62 (24.81)
T2 Anxiety	15.10 (21.97)	5.60 (11.89)	13.75 (20.16)	23.53 (27.95)	16.54 (24.34)	8.82 (16.47)
T2 Angriness	4.16 (11.88)	2.88 (8.26)	5.83 (13.86)	5.42 (13.57)	6.18 (11.434)	6.42 (18.15)
T2 Sadness	29.73 (25.65)	33.60 (31.49)	37.38 (34.59)	47.41 (32.25)	37.38 (28.82)	28.29 (34.55)
T2 Happiness	30.27 (33.59)	39.84 (33.69)	39.92 (34.28)	33.12 (37.65)	40.71 (31.09)	43.78 (35.37)
T3 Anxiety	4.00 (11.11)	2.63 (8.15)	10.71 (18.54)	12.67 (22.88)	6.92 (14.14)	14.26 (23.39)
T3 Angriness	.65 (1.38)	2.16 (6.69)	8.01 (16.56)	6.86 (13.78)	5.23 (10.67)	11.94 (26.98)
T3 Sadness	2.75 (5.68)	2.42 (5.91)	24.86 (27.88)	18.11 (23.87)	12.47 (20.73)	34.38 (32.40)
T3 Happiness	72.18 (30.55)	82.09 (27.25)	53.27 (35.61)	68.86 (32.82)	65.17 (30.995)	46.08 (36.52)
T4 Anxiety	5.15 (18.01)	2.88 (11.58)	5.75 (12.80)	6.01 (15.73)	7.13 (16.65)	4.87 (12.62)
T4 Angriness	1.56 (5.15)	3.30 (11.05)	5.06 (12.62)	3.63 (10.33)	3.14 (7.36)	8.71 (21.40)
T4 Sadness	1.30 (5.9)	1.91 (5.66)	7.83 (15.63)	4.83 (11.27)	7.75 (18.03)	8.82 (17.52)
T4 Happiness	87.63 (18.69)	73.40 (32.58)	67.96 (34.50)	84.24 (22.65)	78.46 (26.16)	74.98 (30.01)
T5 EA	18.97 (4.74)	18.97 (4.99)	19.02 (5.57)	18.74 (4.78)	18.89 (5.58)	19.74(5.54)
T5 AER	143.39 (25.99)	124.35 (29.43)	126.16 (32.44)	128.85 (42.83)	122.99 (35.61)	128.25 (33.93)
T5 MAER	70.35 (11.41)	70.69 (16.23)	72.66 (15.65)	69.37 (17.44)	72.63 (17.99)	69.25 (19.18)
T5 DS	6.92 (5.15)	9.36 (6.86)	9.08 (8.41)	8.17 (7.07)	9.09 (6.05)	9.47 (7.20)
T5 SS	17.02 (4.83)	19.02 (5.93)	18.68 (5.57)	17.81 (4.83)	17.52 (5.45)	16.98 (6.59)

PS problem solving, *DIS* distraction, *ACC* acceptance, *CR* cognitive reappraisal, *TASK* cognitive control task, *RUM* rumination, *T0* baseline emotion regulation and emotional wellbeing, *T1* baseline affective states, *T2* affective states after mood-induction, *T3* affective states after emotion regulation, *T4* affective states after relaxation exercise, *T5* emotion regulation and emotional wellbeing after 6 months, *EA* emotional awareness, minimum score = maximum score = 30, with higher scores indicating less emotional awareness, *AER* adaptive emotion regulation, minimum score = 42 – maximum score = 210, with higher scores indicating a higher use of adaptive ER strategies, *MAER* maladaptive emotion regulation, minimum score = 30 – maximum score = 150, with higher scores indicating a higher use of maladaptive ER strategies, *DS* depression symptoms, minimum score = 0 – maximum score = 54, with higher scores indicating more depressive symptoms, *SS* stress symptoms, minimum score = 0 – maximum score = 40, with higher scores indicating higher perceived stress

($p = 0.095$) are not homogeneous across the three age groups in our sample, reflecting altering variability in use of ER strategies between the ages 11 and 13. However, as the average use of adaptive and maladaptive ER strategies does not have a significant impact on change scores, $F(8, 502) = 0.852$, $p = 0.557$, and follow-up outcome variables, $F(10, 482) = 0.740$, $p = 0.687$, age was not included as a covariate of interest.

Results for Happy Affect

Results revealed an overall significant interaction effect of condition and time, $F(15, 756) = 5.830$, $p < 0.001$, $\eta_p^2 = 0.104$. Within and Between Subject-Effects showed a significant main effect on time, $F(3, 9639) = 170.097$, $p = < 0.001$, $\eta_p^2 = 0.403$, but not on condition, $F(5, 1343) = 0.727$, $p = 0.603$, $\eta_p^2 = 0.014$. An overview of the scores on happy affect over the four time points is depicted in Fig. 2. Pairwise comparisons showed an overall decrease in happy affect between T1 and T2 in all conditions ($p < 0.001$), suggesting a successful mood-induction. Second, there was an overall increase in happy affect between T2 and T3 in all conditions ($p < 0.005$), except for the RUM condition ($p = 0.046$). Finally, results showed a significant increase in happiness between T3 and T4 in all conditions, indicating a successful relaxation ($p < 0.005$).

To examine the differential effects of *ER skills* on happy affect, a MANCOVA was used to compare the scores between T2 (after mood-induction) and T3 (after the use of the ER skill). An overview of the differences between scores can be found in Table 2. Results revealed a significant effect of condition on the change score in happy affect, $F(5, 11{,}006) = 9.790$, $p < 0.001$. Levene's test of equality of error variances was not significant, $F(5, 255) = 2.201$, $p = 0.055$, demonstrating that the error variances were equal across conditions. Therefore, LSD post-test was used to compare the change scores on happy affect between conditions. Results revealed the highest increase in happy affect in the DIS and PS condition, followed by the CR condition. These three change scores were all significantly higher compared with the ACC condition and the RUM condition. The change in happy affect in the TASK condition did not significantly differ from the other conditions, except from the RUM condition.

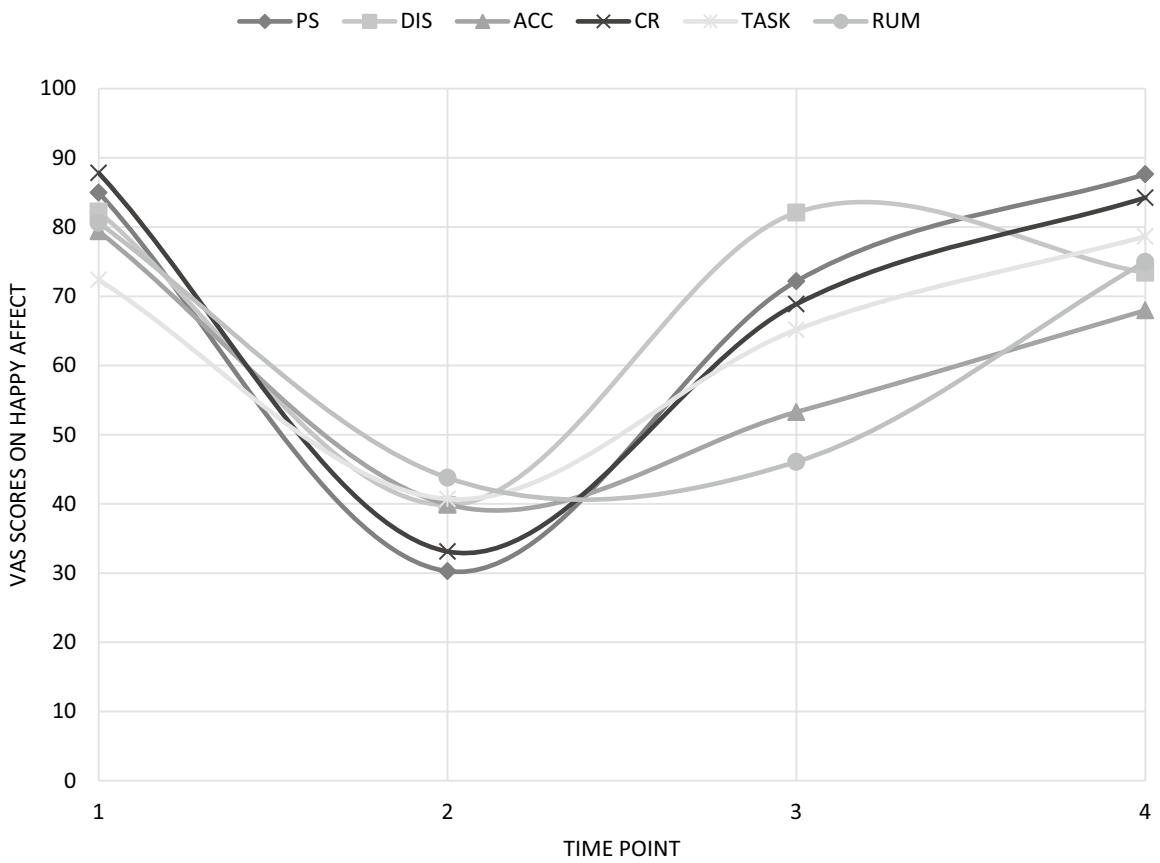

Fig. 2 Mean scores on happy affect per condition through different time points

Table 2 Mean differences in change scores (T3–T2) on happy affect between conditions (I–J)

		DIS	CR	PS	TASK	ACC	RUM
(I)	DIS		6.847	.529	14.121	27.728**	40.168**
	CR	−6.847		−6.318	7.274	20.881*	33.321**
	PS	−.529	6.318		13.592	27.199**	39.639**
	TASK	−14.121	−7.274	−13.592		13.607	26.047*
	ACC	−27.728**	−20.881*	−27.199**	−13.607		12.440
	RUM	−40.168**	−33.321**	−39.639**	−26.047*	−12.440	

PS problem solving, *DIS* distraction, *ACC* acceptance, *CR* cognitive reappraisal, *TASK* cognitive control task, *RUM* rumination

*p < .05, **p < .001

Results for Sad Affect

Multivariate tests revealed a significant interaction effect of condition and time, F (15,756) = 5.487, $p < 0.001$, $\eta_p^2 = 0.098$, with both main effects of time, $F(2, 1849) = 3.831$, $p = 0.024$, $\eta_p^2 = 0.015$ and condition, $F(5, 3270) = 3.922$, $p = 0.002$, $\eta_p^2 = 0.072$. An overview of the scores on sad affect across the four time points is depicted in Fig. 3. More specifically, pairwise comparisons showed an overall significant increase between T1 and T2 in all conditions ($p < 0.001$). These findings reveal that sad affect significantly increased after watching the film clip in all conditions indicating a successful mood-induction. Moreover, there was a significant decrease in sadness between T2 and T3 in all conditions ($p < 0.002$), with the exception of the RUM condition ($p = 0.149$). Finally, results showed a significant decrease in sadness between T3 and T4 in the ACC, CR and RUM group ($p < 0.001$).

Furthermore, MANCOVA revealed a significant effect of condition on the *change score in sad affect*, $F(5, 7966) = 9.959$, $p < 0.001$, $\eta_p^2 = 0.167$. Levene's test of equality of error variances was not significant, $F(5, 255) = 1.105$, $p = 0.358$, indicating that the error variances were equal across groups. Therefore, LSD was used to compare the

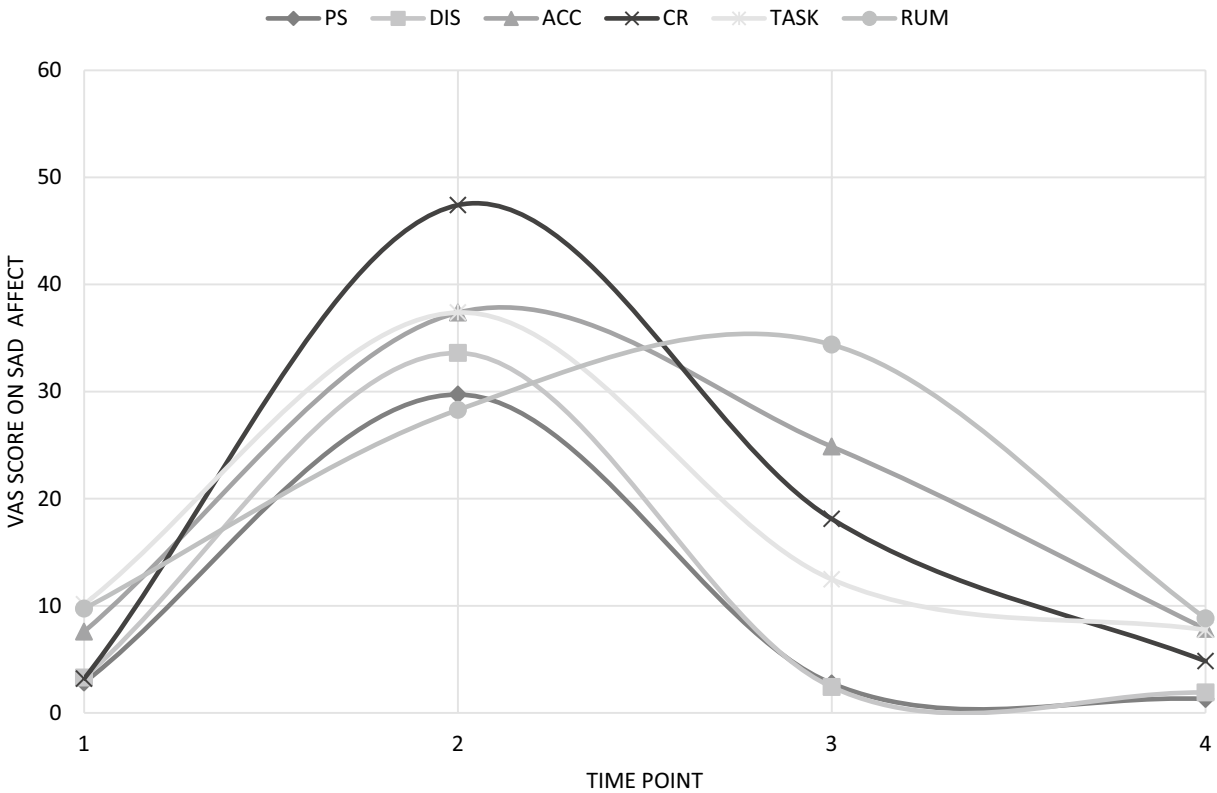

Fig. 3 Mean scores on sad affect per condition through different time points

change scores on sad affect between conditions. An overview of the differences between scores on T2 and T3 can be found in Table 3. Multiple comparisons revealed that the highest decrease in sad affect between T2 and T3 was found in the DIS condition, the CR condition, the PS condition, and the TASK condition. No significant differences were found between these four conditions. However, all conditions showed significant differences with both the ACC and the RUM condition. Furthermore, the decrease in sad affect in the ACC condition was also significantly different from the increase in sad affect in the RUM condition.

Results for Anxious Affect

Results revealed a significant interaction effect of condition and time, $F(15, 765) = 2.970$, $p < 0.001$, $\eta_p^2 = 0.056$, with no significant main effect of time, $F(3, 277) = 1.352$, $p < 0.256$, $\eta_p^2 = 0.005$, and a significant main effect of condition, $F(5, 1328) = 2.686$, $p = 0.022$, $\eta_p^2 = 0.051$. An overview of the scores on anxious affect over the four time points is depicted in Fig. 4. More specifically, contrasts showed an increase between T1 and T2 in all conditions except for the TASK ($p = 0.380$) and DIS ($p = 0.276$) condition. The findings revealed that anxious affect increased significantly after watching the film clip in the PS, ACC, CR, and RUM condition, indicating a successful mood-induction. Furthermore, there was a significant decrease in anxious affect between T2 and T3 in all conditions with the exception of the rumination condition ($p = 0.077$). Finally, results showed a significant decrease in anxious affect between T3 and T4 in the RUM, CR, and ACC condition ($p < 0.005$), indicating a successful relaxation exercise.

Additionally, a MANCOVA revealed a significant effect of condition on the differences in scores between T2 and T3 for *anxious* affect, $F(5, 1562) = 3.670$, $p = 0.003$, $\eta_p^2 = 0.068$. Levene's test of Equality of Error Variances was significant, $F(5, 255) = 1.105$, $p = 0.044$, indicating that the error variances were not equal across groups. Therefore, Games–Howell posttest was used to compare the change scores on anxious affect between conditions. An overview of the change scores can be found in Table 4. Multiple comparisons revealed the highest decrease in anxious affect in the PS condition, the CR condition, and the TASK condition, which all showed significant differences compared with the RUM condition. Lower decreases in anxious affect were found in the DIS and ACC condition, but these differences were not significantly different compared with the other conditions.

Results for Angry Affect

Results showed no significant interaction effect between condition and time, indicating no significant differences between conditions and time points, $F(15, 765) = 1.002$, $p = 0.451$, $\eta_p^2 = 0.021$. As can be seen in Fig. 5, the mood-induction did not influence angriness. Therefore, no further analyses were conducted for this type of affect. An overview of the scores on angry affect across the four time points is depicted in Fig. 5.

Effect on the lack of emotional awareness, depressive- and stress Symptoms, and the Use of Emotion Regulation Strategies at 1-Month Follow-Up

RM-ANOVAs revealed no significant interaction effects between condition and time on lack of emotional awareness, $F(5, 230) = 1.405$, $p = 0.223$, $\eta_p^2 = 0.03$, the use of adaptive ER strategies, $F(5, 250) = 0.843$, $p = 0.520$, $\eta_p^2 = 0.17$, the use of maladaptive ER strategies, $F(5, 250) = 0.343$, $p = 0.887$, $\eta_p^2 = 0.01$, depressive symptoms, $F(1, 255) = 0.901$, $p = 0.480$, $\eta_p^2 = 0.017$, and stress symptoms, $F(5, 250) = 0.827$, $p = 0.531$, $\eta_p^2 = 0.016$, at 1-month follow-up.

Post-hoc analyses revealed that the power to detect results at 1-month follow-up was rater low (βs ranging from 0.14 to 0.49). In order to increase power, RM ANOVAs were conducted with two conditions instead of six, that is one intervention condition (combining CR, ACC, DIS, and PS) and one control condition (combining RUM and TASK). Again,

Table 3 Mean differences in change scores (T3–T2) on sad affect between conditions (I–J)

		(J)					
		DIS	CR	PS	TASK	ACC	RUM
(I)	DIS		−2.650	−4.489	−6.209	−18.139*	−36.217**
	CR	2.650		−1.839	−3.559	−15.489*	−33.567**
	PS	4.489	1.839		−1.720	−13.650*	−31.728**
	TASK	6.209	3.559	1.720		−11.930*	−30.008**
	ACC	18.139*	15.489*	13.650*	11.930*		−18.078*
	RUM	36.217**	33.567**	31.728**	30.008**	18.078*	

PS problem solving, *DIS* distraction, *ACC* acceptance, *CR* cognitive reappraisal, *TASK* cognitive control task, *RUM* rumination

*p < .05, **p < .001

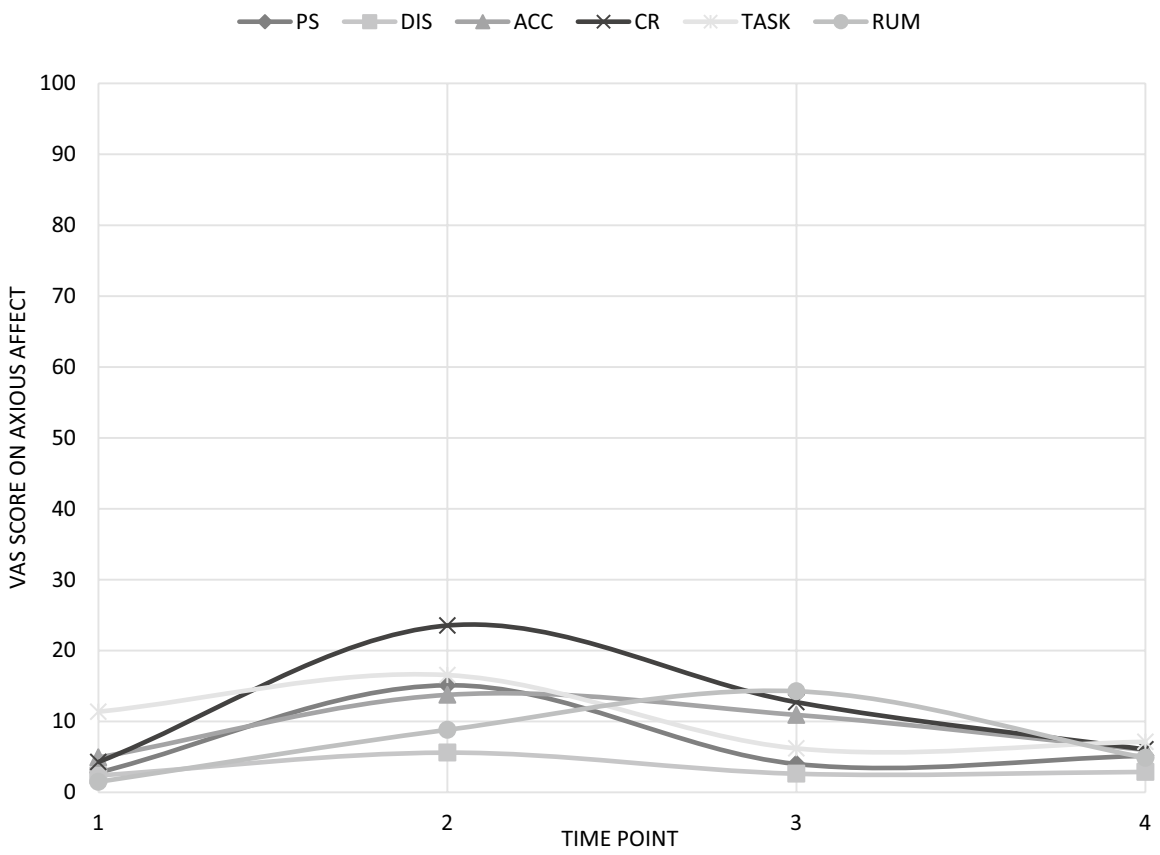

Fig. 4 Mean scores on anxious affect per condition through different time points

Table 4 Mean differences in change scores (T3–T2) on anxious affect between conditions (I–J)

		(J)					
		DIS	CR	PS	TASK	ACC	RUM
(I)	DIS		7.781	8.110	5.183	−.248	−8.040
	CR	−7.781		.329	−2.597	−8.092	−15.820*
	PS	−8.110	−.329		−2.926	−8.358	−16.150**
	TASK	−5.183	2.597	2.926		−5.431	−13.223*
	ACC	.248	8.029	8.358	5.431		−7.792
	RUM	8.040	15.820*	16.150**	13.223*	7.792	

PS problem solving, *DIS* distraction, *ACC* acceptance, *CR* cognitive reappraisal, *TASK* cognitive control task, *RUM* rumination

*p < .05, **p < .001

all condition × time interaction effects were non-significant while the observed power further decreased (βs ranging from 0.06 till 0.26).

Discussion

The goal of the current study was to investigate (1) the immediate effects of teaching young adolescents emotional awareness and one of the four well-known adaptive ER skills (i.e., ACC, DIS, CR, and PS) on regulating an experimentally induced negative affective state, (2) as well as their sustained effects on one's general ER skills (i.e., lack of emotional awareness and the general use of adaptive and maladaptive ER strategies) and emotional wellbeing (i.e., depressive- and stress symptoms) after 1-month follow-up. (3) Lastly, the current study aimed to explore the differential effects of the trained ER skills. It was hypothesized that young adolescents who were trained and stimulated to be aware of their own feelings and to use one of the four

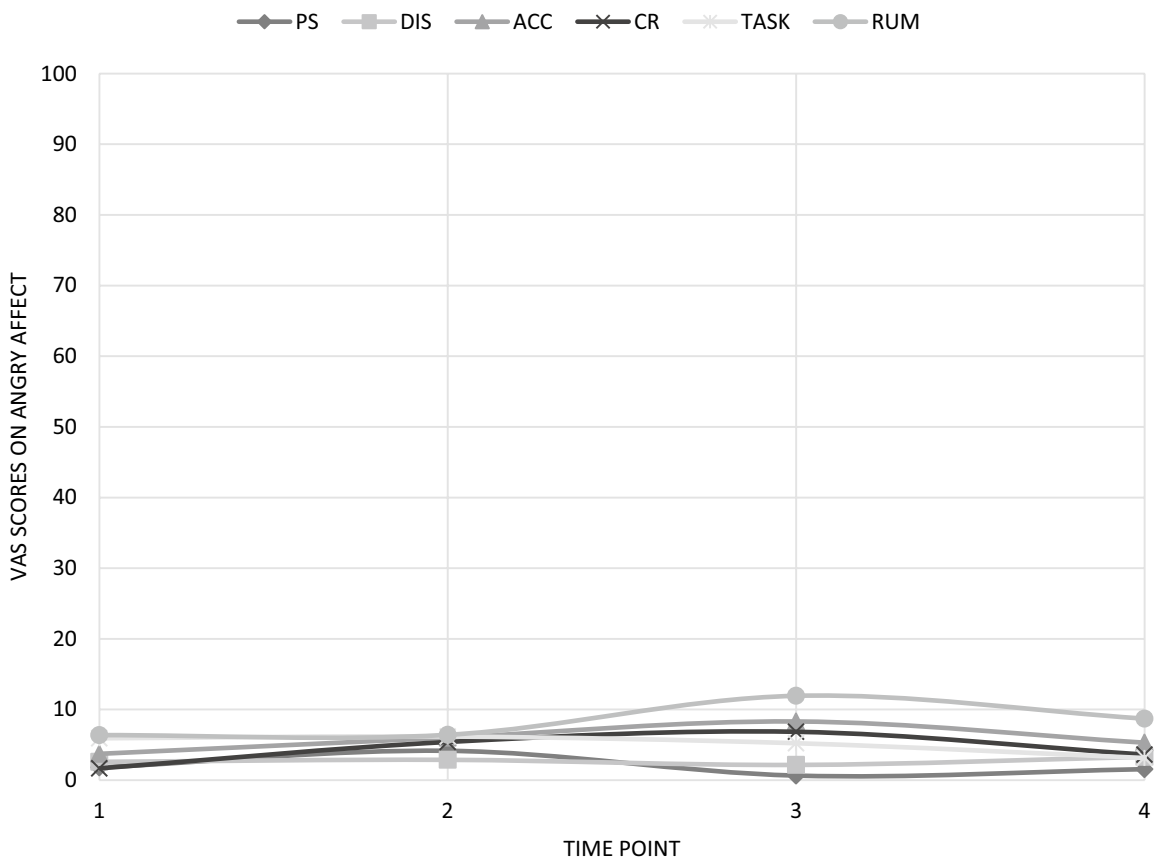

Fig. 5 Mean scores on angry affect per condition through different time points

specific adaptive ER skills would be better at immediately upregulating positive (i.e., happiness) and downregulating negative affect (sadness, anxiety, and angriness) after a negative mood-induction, and that the training would also have sustained effects on overall ER skills and emotional wellbeing at 1-month follow-up in comparison with young adolescents who are stimulated to ruminate (control condition 1) or to perform a cognitive task (control condition 2). It was further hypothesized that adolescents in the experimental conditions (i.e., ACC, DIS, CR, or PS), as compared to adolescents in the control conditions, would report a *bigger increase* in positive emotions and a *smaller decrease* in negative emotions after the negative mood-induction, and *less* problems with emotional awareness, a *higher* use of adaptive ER strategies, a *lower* use of maladaptive ER strategies, and *less* depressive- and stress symptoms at 1-month follow-up. Furthermore, it was hypothesized that within the experimental conditions, the DIS training would have the strongest and most beneficial effects, followed by training CR; whereas ACC and PS would have lower effects in comparison to these ER strategies.

Overall results pertaining the immediate effects showed a significant decrease in negative affect and an increase in happy affect after regulating the induced mood using a learned ER skill but also after performing a cognitive control task which was one of the control conditions. These results indicate that performing a cognitive control task showed to be equally effective as using specific adaptive ER strategies in successfully regulating the induced negative emotions. It can be assumed that, especially for early adolescents that do not report clinical significant psychopathology symptoms, performing a neutral cognitive task serves as a distracting activity that tempers negative affect and increases positive affect, at least short-term. However, an important distinction with the experimental DIS condition should be made. In the DIS condition, participants were informed about potential distractive activities that can be performed as a way of actively regulating negative emotions and were explicitly instructed to use DIS after the mood-induction, thereby making the ER goal *explicit* (i.e., explicit distraction). In the task condition, participants did not receive any information prior to the mood-induction and resumed the neutral task without receiving any additional or explicit instructions, which makes the nature of the ER goal implicit (i.e., implicit distraction) (Braunstein et al. 2017). It is clear that further

research should disentangle the supplementary and long-term effects of an ER skills training compared to an uninstructed cognitive distraction task. Moreover, the effects of such a training should be further explored in a sample consisting of youth experiencing more intense negative affect or more symptoms of psychopathology compared to the present community sample.

Results also suggest that adolescents are able to learn and to use ACC, DIS, CR, and PS effectively. Note that the immediate effects of the ERT on adolescents' levels of anger affect were non-existent throughout the experiment, thereby confirming that the film clip did not evoke feelings of anger. Therefore, further discussion about the findings pertaining to the immediate effects of the trained ER skills on negative affective states are limited to sad and anxious affect. Current results are in line with previous studies that showed immediate positive effects of instructed ACC, DIS, and CR on adolescents' induced mood (Hilt and Pollak 2012; Rood et al. 2012; Wante et al. 2017), but in addition, suggest that this ACC may be less effective in comparison with the use of DIS, CR, or PS. As ACC is a relatively complex ER skill (Biglan et al. 2008; Hayes et al. 1999, 1996), it is likely that a more prolonged ERT—consisting out of multiple sessions—may yield stronger effects. As 'ACC' refers to becoming aware of one's own feelings, observe them as they are, and accept them without judging them (Williams et al. 2000), it is also possible that the lower scores on happy affect and higher scores on sad affect (compared with the other intervention conditions) indicate that adolescents successfully used this ER skill, i.e., they became aware of their feelings and left them as they are. This line of thought could also explain why Rood et al. (2012) found that ACC was not more effective than RUM in dealing with induced negative mood. In addition, this finding is in line with the conceptualization of ACC as an ER skill (rather than an ER strategy) within the ERT, where the main goal of ACC is not to *regulate* one's own emotions (i.e., increase or decrease affect) but rather to facilitate a flexible use of adaptive ER strategies such as CR, PS, and DIS. As noted earlier, ACC moderates the automatic response of the individual to fight or avoid the experienced emotion (Hayes et al. 1999, 1996), which in turn reduces the probability of choosing a maladaptive ER strategy such as suppression, avoidance, or aggression to regulate the experienced emotion (Hayes et al. 2001). This allows an individual to expand his or her ER strategy repertoire, open up to contextual information, and get in touch with one's personal goals (Hayes et al. 2012) which increases the chance of choosing an ER strategy that is in line with the contextual demands and personal goals, and thus of flexibly and adaptively regulating the emotion (Aldao et al. 2015). This indicates that ACC is probably most effective when combined with adaptive ER strategies and could explain why ACC is an effective core component of broader prevention programs (Biglan et al. 2008; Burckhardt et al. 2016; Raes et al. 2014).

Furthermore, the current study was also the first to investigate the effect of PS as a stand-alone strategy and results also suggest adaptive immediate effects of this ER strategy on positive and negative affective states after an emotion-eliciting event. Moreover, PS showed to be equally effective in increasing positive affect and decreasing negative affect as DIS and CR, confirming previous findings on adaptive ER strategies (Hilt and Pollak 2012; Rood et al. 2012; Wante et al. 2017). However, it remains unclear whether the promising effects are the fruit of all steps of the PS process or solely resulted from the generated solution step. Furthermore, it was hard to distinguish the effects of PS from those of all other adaptive ER skills, as some adolescents solved the emotional problem (i.e., negative mood-induction) by engaging in a distracting activity (DIS) or by replacing negative thoughts by more helpful thoughts (CR). Research should further examine the effectiveness of PS as a stand-alone strategy in-depth by for example including a manipulation check for the different PS components.

To summarize, present findings indicate that instructed RUM, and to a lesser extent trained ACC, lead to the maintenance (or even higher) levels of negative affect in the short term as compared to trained DIS, CR, and PS, which seem to sort similar and beneficial effects on negative and positive affect. RUM seems to lead to the maintenance of low levels of positive affect and an increase in negative affect, a finding that is consistent with previous studies in younger age groups (Roelofs et al. 2009; Treynor et al. 2003; Wante et al. 2017). However, our findings pertaining to the ACC condition are inconsistent with the results of Wante et al. (2017), who found that ACC was equally effective as using CR, and that ACC and CR were less effective compared to the use of DIS in dealing with experimentally induced negative affect. This discrepancy in findings can be due to several small differences in the study procedure of both studies. While Wante et al. (2017) used step-by-step group instructions on how to regulate emotions *after* the mood-induction, young adolescents in the current study participated in a short ERT *before* the mood-induction. Furthermore, in the current study participants were instructed to use the learned skill independently and individually after the mood-induction with help from written step-by-step instructions. This indicates that young adolescents may have sufficient cognitive and emotional capacities to follow instructions on DIS, CR, and ACC, but that the instructions may not be enough to practice all skills equally thorough. As shown by previous research, DIS requires less cognitive resources than other ER skills since the incoming emotional information is blocked early in the emotion generation process (Sheppes et al. 2014). Therefore, it is plausible that the instructions given in the current study were enough to effectively induce the use of

this ER strategy—in contrast to the CR and ACC instructions. This may also explain why experimentally trained DIS is most researched in the laboratory and has repeatedly been shown to yield short-term positive effects in both adults and adolescents (Hilt et al. 2010; Hilt and Pollak 2012; Scheibe et al. 2015). In addition, CR and PS may be trained more effectively by means of a short ERT, similar to the one used in the current study, whereas ACC would require an even more extensive training.

Lastly, the current study was the first to examine the effects of learning one adaptive ER skill on global ER skills (i.e., emotional awareness, the use of adaptive, and maladaptive ER strategies) as well as its effect on emotional wellbeing (i.e., depressive- and stress symptoms) after 1-month follow-up. Results suggested that there were no long-term influences of the ER skills on the lack of emotional awareness, the use of adaptive and maladaptive ER strategies, depressive symptoms, and stress symptoms. The major explanation for this non-significant finding can be found in the fact that our design was underpowered (βs ranging from 0.14 to 0.49) to detect the expected small effects. However, alternative, non-methodological, explanations for the lack of findings pleading for sustained beneficial effects of a short ERT can be proposed. First, no sustained effects could be found on the outcome measures pertaining to a lack of emotional awareness and the overall use of ER strategies. It is possible that a more extensive intervention, including the training of different specific ER strategies in combination with take-home exercises, are needed to increase the overall use of adaptive ER strategies in daily life. Prior research already highlighted the importance of using different ER strategies in a variety of contexts, rather than consistently using one specific adaptive ER strategies in every situation (e.g. Bonanno and Burton 2013). For example, CR has shown to be effective in the long term since it facilitates long-term adaption, but it has also showed to be less effective when stimulus intensity increases (McRae et al. 2012). Therefore, we assume that combining ACC with CR—to decrease the risk for avoidance—as well as DIS—in order to reduce stimulus intensity—would yield stronger effects (Sheppes et al. 2011; Wilson and Gilbert 2008; Wolgast et al. 2011). Further research will need to examine the effects of a more prolonged ERT combining different ER skills. Second, since theoretical models on ER have widely recognized the role of ER in the development and maintenance of psychopathology symptoms (Fairburn et al. 2003; Kovacs et al. 2008; Mennin et al. 2007), changes in emotional wellbeing can only be expected along with changes in the use of ER strategies. Third, previous research has already found evidence for the prevalent use of the abovementioned ER skills in school samples (Braet et al. 2014) demonstrating that young adolescents generally own an adaptive ER skill set. Despite it is ethically more reasonable to strengthen ER skills of all young adolescents, adolescents with heightened psychopathology symptoms and associated deficits in ER may profit most from learning ER skills. This may likely result in both stronger effects on immediate affect (e.g., different effects compared to a cognitive control task) and long-term effects on ER and emotional well-being. Therefore, future research has to replicate the current design in a clinical sample of young adolescents.

Limitations

Despite the notable strengths of the present study, some important limitations warrant discussion. First, the current findings are based solely on self-report measures which can have some notable implications, especially for the interpretation of the results pertaining to the follow-up questionnaires. First, relying exclusively on self-report measures may result in common method bias. Specifically, measuring all follow-up outcomes with one common method (self-report questionnaires) may inflate the true associations between the included variables through shared method variance (Lindell and Whitney 2001). Moreover, self-report questionnaires are sensitive to social desirability bias, i.e., the tendency to give culturally and socially acceptable answers (Crowne and Marlowe 1960), which may decrease the variability between individuals and conditions. Another limitation of relying completely on self-report measures when investigating internal processes such as ER is that the responses of an individual often reflect their confidence or belief in their ER ability rather than their actual (objective) ER skills (Salters-Pedneault et al. 2006). Finally, findings that are based on self-report can be influenced by state motivations, expectations, and other contextual factors (Kaplan and Stone 2013; Paulhus and Vazire 2007). As the self-report of internal processes may be driven by how much confidence an individual has in his or her ER abilities, momentary environmental conditions, and motivational states this may (at least partially) explain the lack in findings at 1-month follow-up. Although previous research has shown that adolescent self-report is valuable (De Los and Kazdin 2005), adding multi-informant measures such as parent- and/or teacher report on adolescents' emotional wellbeing and affective states is preferable. Moreover, recent research suggests that psychophysiological outcomes like cortisol (Ryan et al. 2016), heart rate variability (Thayer et al. 2012), and respiratory sinus arrhythmia (Beauchaine et al. 2019) can be used to increase the validity and reliability of outcomes on ER and emotional wellbeing in young adolescents. Second, current study's sample is limited by a relatively small age range (11–13 years). Since adolescence is known as an important and turbulent phase for emotional- and cognitive development (Steinberg 2005), generalization of the current study's results is restricted to the subject population. Third, the adolescents receiving the

ERT did not only receive more information on emotions and ER compared with the control groups, but were also confronted with broader, general instructional material. Therefore, it is possible that this general instructional material helped to improve children's ER skills. Furthermore, the methods used in the ERT conditions were different for each group. In one experimental group, adolescents played a game, while in another group adolescents were instructed to brainstorm. Both methods may form powerful confounds that could have influenced the current results. Fourth, whereas the ERT included ER skills that were based on both top-down (i.e., cognitive, involving attention and control, monitoring, and explicit regulation) and bottom-up (i.e., affective, involving arousal, valence, and implicit regulation) processes, we only examined the effects of the top-down systems including cognitive control. Future research should also focus on the effectivity of distinct bottom-up skills in young adolescents by targeting bodily representations of emotional states (Guendelman et al. 2017). A final limitation is the lack of power to detect statistically significant effects on affect and psychological parameters after 1-month follow-up, which may have increased the probability of making a type-II error. In addition to attempts to enlarge sample size of individual studies, combining individual studies in a meta-analysis, increases the overall statistical power to detect effects. Other than an appropriate sample size, power can be influenced by the amount of differences between groups and the size of effect sizes. To increase the power in future studies, researchers should focus on strategies to increase the magnitude of group differences, such as targeting appropriate mediators, stimulate treatment integrity by reducing the number of trainers who deliver the program, and measure outcomes repeatedly over a longer period of time. Furthermore, researches should use strategies for reducing variance such as sampling control (Hansen and Collins 1994).

Conclusion

To conclude, the current study is novel in investigating both the immediate and long-term effects of experimentally trained ER skills (ACC, DIS, CR, and PS) in young adolescents age 11 to 13 years and builds upon the limitations of previous studies (Rood et al. 2012; Wante et al. 2017) by (1) preceding the ERT with learning youth emotional awareness, (2) including PS as a stand-alone ER strategy, and (3) including a neutral control group (i.e., cognitive task) apart from a RUM control group. Results revealed that ACC, DIS, CR, and PS as well as the cognitive task (TASK) were successful in regulating the immediate—experimentally induced—negative emotions, whereas RUM lead to the maintenance and even an increase in negative affect. Compared to a poorer effect for ACC, the effects for DIS, PS, and CR were more pronounced. Considering the long-term effects, we had insufficient data to formulate scientifically sound conclusions. Overall, these results demonstrate that young adolescents are able to learn and use ACC, DIS, CR, and PS for successfully regulating negative emotions, at least short-term. Results open the door to the question of effective ER-based prevention programs and sets the stage for future research to replicate these findings in a larger sample of youth as well as in adolescents with psychiatric disorders, using multiple methods and questioning multiple informants, and examine the long-term effects of a more prolonged and extensive ERT.

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Compliance with Ethical Standards

Conflict of Interest CB is co-author of the official Dutch translation of both the Children's Depression Inventory (CDI) and the Fragebogen zur Erhebung der Emotionsregulation bei Kindern und Jugendlichen (FEEL-KJ) and received 10 royalties for this. BV, LW, M-LB and LV declare that they have no competing interests.

Ethical Approval All procedures performed in current study were in accordance with the Ethical Standards of the Ethical Committee of Ghent University and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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