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DOI 10.1007/s11031-012-9288-3

ORIGINAL PAPER

Mental contrasting with implementation intentions enhances self-regulation of goal pursuit in schoolchildren at risk for ADHD

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Abstract Self-regulation is an important prerequisite for successful academic achievement, particularly for children who are at risk for Attention Deficit Hyperactivity Disorder (ADHD). We taught Mental Contrasting with Implementation Intentions (MCII), a technique that is known to facilitate the self-regulation of goal pursuit, to schoolchildren (sixth- and seventh-graders) both at risk and not at risk for ADHD. Parents rated their children's level of self-regulation 2 weeks after the intervention. Children at risk and not at risk benefited from MCII more than from a learning style intervention only and the benefits of MCII were particularly strong for children at risk for ADHD. The results have implications with respect to supporting children's self-regulation in their everyday school lives.

Keywords Self-regulation · Mental contrasting · Implementation intentions · Children at risk for ADHD

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Introduction

People with higher levels of self-regulation reach comparatively more satisfying outcomes in various life domains (i.e., health, career, relationships; Tangney et al. 2004). Similarly, self-regulation has been shown to lead to cognitive competence and strong academic performance in children. That is, the more self-regulated children are, the more successful in school they are (Duckworth 2011; Shoda et al. 1990). Self-regulation has been shown to foster successful performance by facilitating effective goal pursuit (Bargh et al. 2010; Gollwitzer and Oettingen 2011; Oettingen and Gollwitzer 2010), as it supports "self-corrective adjustment" by strengthening various goal-directed processes (Carver and Scheier 2011, p. 3). In other words, self-regulation enables people to alter their thoughts, emotions, and actions to achieve a desired outcome (Bauer and Baumeister 2011). In the present study, we focus on self-regulation aimed at goal pursuit in the area of managing school-related activities (e.g., homework, preparing for class)—an area in which children at risk for Attention Deficit Hyperactivity Disorder (ADHD) frequently have trouble (August and Garfinkel 1989). These considerations imply that children at risk for ADHD should particularly benefit from being taught self-regulation strategies that bolster goals in the area of homework and class preparation. On the long run, increasing homework and bettering preparation for school will improve the children's cognitive skills. Therefore, supporting self-regulation of goal pursuit in children at risk for ADHD is an important aim of educational interventions.

Self-regulation of goal pursuit: Interventions

Research outside the field of education suggests that interventions have the potential to improve the self-regulation

Published online: 21 March 2012

of goal pursuit. As goal pursuit encompasses both goal setting and goal striving, a strategy combining self-regulation tools well known to enhance goal setting and goal striving should be particularly useful (Oettingen and Gollwitzer 2010). Indeed, a strategy, called mental contrasting with implementation intentions (MCII), as it addresses both goal setting and goal striving was found to facilitate self-regulated behavior change. For example, in middle aged women, compared to relevant control conditions MCII increased the level of regular physical exercise (Stadler et al. 2009) and of eating a healthy diet (Stadler et al. 2010). In patients with chronic back pain, MCII benefited objectively and subjectively assessed physical mobility immediately after the intervention and over the period of 3 months (Christiansen et al. 2010). Finally, in college students who used MCII to address their unhealthy snacking habits, Adriaanse et al. (2010) showed that MCII was more effective in reducing the unhealthy habits than its individual components, mental contrasting and implementation intentions, alone. Recent research replicated the beneficial effect of MCII on adolescents in the educational area: In a brief intervention to improve studying for a standardized college entrance examination, 10th-graders in the MCII condition completed more practice items over the summer holidays than those who received an information control intervention (Duckworth et al. 2011).

Mental contrasting as a self-regulation strategy of goal setting

In mental contrasting, people first name their most important concern in a specific area (e.g., to get a better math grade). Next, they imagine and elaborate on the positive future, which relates to the successful achievement of this concern (e.g., being proud of oneself). Finally, they imagine and elaborate on those aspects of the present reality that stand in the way of their successful achievement (e.g., one finds it boring to spend extra time working on math problems). In doing so, expectations of success become activated and when expectations of successfully reaching the desired future are high, mental contrasting leads to strong goal commitment—people commit to and effectively strive toward achieving the desired future. Conversely, when expectations are low, people explicitly refrain from committing to and striving toward the desired future. That is, mental contrasting leads to sensitivity for the feasibility of a concern and thus to selective goal commitment and goal striving. Such selective goal commitment saves resources: People neither spend energy on impossible goals nor do they lose sight of goals that are in reach.

Experimental research attests to the effectiveness of mental contrasting (review by Oettingen, in press). Mental contrasting spurs selective goal commitment across life domains, age groups, cultures, and for short-term and long-term measures of commitment. For example, in the academic area, mental contrasting of feasible wishes benefited academic achievement and personal development (Oettingen et al. 2001, 2005), in the interpersonal area it benefited problem solving and effective search for a romantic partner (Oettingen 2000; Oettingen et al. 2001), and in the health domain it benefitted healthy dieting and exercise (Johannessen et al., in press). Finally, mental contrasting also allowed students to use effective instrumental means such as seeking help where help was needed (Oettingen et al. 2010).

Regarding the motivational and cognitive processes mediating mental contrasting effects, research has identified energization (as measured by subjective and objective indicators; Oettingen et al. 2009) and planning (as measured implicitly and explicitly; Oettingen et al. 2001, 2005). In addition, mental contrasting modulates the implicit association (mental link) between the desired future and the impeding obstacle of reality, as well as between the obstacle and instrumental means (Kappes and Oettingen 2012; Kappes et al., in press). Importantly, these mental links mediated goal commitment as measured by effortful action and successful performance. In other words, mental contrasting of feasible wishes induced strong mental links between future, reality, and instrumental means which in turn fostered strong effort and effective performance.

Implementation intentions as a self-regulation strategy of goal striving

Despite showing strong goal commitment individuals still may not act upon it in everyday life (Webb and Sheeran 2006). Supplementing a goal to which people feel committed (e.g., "I would like to get a better math grade on my next report card") with an if–then plan (e.g., "And whenever I have finished dinner, then I will sit down and work on my math homework assignment") makes goal realization more likely (Gollwitzer 1999). A meta-analysis on the goal attainment facilitating effect of if–then plans involving more than 8,000 participants in 94 independent studies showed an effect size of $d = 0.65$ (Gollwitzer and Sheeran 2006). This medium-to-large effect size (Cohen 1992) represents the additional facilitation of goal achievement through if–then plans compared to goal intentions alone, and thus indicates that if–then plans provide benefits beyond mere goal intentions.

The mental links created by if–then plans support goal attainment on the basis of psychological processes that relate to both the anticipated situation and the intended behavior. Forming an if–then plan implies the selection of an anticipated

situation (if-part). Thus, the mental representation of this situation becomes highly activated and more accessible, meaning that people are more likely to identify the anticipated critical situation when they subsequently encounter it (e.g., Aarts et al. 1999; Parks-Stamm et al. 2007; Webb and Sheeran 2004, 2008). In addition, if–then plans forge a strong association between the critical cue (determined in the if-part) and the specified response (determined in the then-part; Webb and Sheeran 2007). Thus, the initiation of the goal-directed behavior acquires features of automaticity. In the presence of the specified situation, action initiation is immediate, efficient, and no longer requires conscious intent (e.g., Bayer et al. 2009; Brandstätter et al. 2001). Both mechanisms, the heightened accessibility of the cue and the automatic activation of the intended behavior in the presence of the critical cue, have been shown to mediate the effects of if–then plans on behavior (e.g., Webb and Sheeran 2007).

Mechanisms of MCII

Mental contrasting and forming if–then plans complement each other as self-regulatory strategies for fostering goal attainment (Oettingen and Gollwitzer 2010). This is because mental contrasting creates the strong goal commitment that is a prerequisite for if–then plans to be effective (Sheeran et al. 2005). In addition, mental contrasting facilitates the recognition of obstacles that hinder goal striving. When planning out goal-pursuit, these obstacles can be linked to goal-directed actions that will overcome, circumvent, or prevent them. Accordingly, MCII by targeting both goal setting and goal striving is highly effective for inducing desired behavior change in a variety of life domains.

Schoolchildren at risk for ADHD

Can MCII enhance school-related goal pursuit in children who show symptoms of inattentiveness, hyperactivity, and impulsivity, and are thus at risk of ADHD (APA 2000)? Children at risk for ADHD are characterized by impairments typical of ADHD (e.g., Barkley 1997). However, these symptoms are not sufficient quantitatively to assure a diagnosis and the "clear evidence of clinically significant impairment in social, academic, or occupational functioning" (DSM-IV; APA 2000, p. 66) is not necessarily present in children with a mere risk for ADHD (DuPaul and Stoner 2003). A recent study revealed that 4.9 % of children aged 3–17 years are suspected ADHD cases and thus are considered to be in the borderline significant range for ADHD (Huss et al. 2008).

In comparison to children without ADHD, children at risk for ADHD tend to receive poorer grades in school and they are more likely to have to repeat a school year (Frazier et al. 2007). Furthermore, they often require tutoring or placement in special classes (Riccio et al. 2006). So far, educational interventions for children with ADHD or at risk for ADHD mainly have consisted of token reinforcement systems and response cost systems (DuPaul and Stoner 2003). However, a meta-analysis indicates that alternative interventions teaching self-monitoring and self-management strategies actually can help children with ADHD to improve performance on tasks that require executive control (Reid et al. 2005). Although the studies reported in the meta-analysis did not specifically target the self-regulation of goal pursuit, the paper suggests that interventions designed to support the self-regulation of goal pursuit might be promising, especially in children at risk for ADHD. To date, however, little attention has been paid to interventions targeting the self-regulation of goal pursuit in the school context for children at risk for ADHD.

Self-regulation in children at risk for ADHD

Is it possible to enhance self-regulation in children, who are known to have self-regulation deficits, by teaching them strategies for goal setting and goal implementation? There are findings that suggest a positive answer to this question, at least with respect to the effects of forming implementation intentions. If–then plans helped children with ADHD solve inhibition tasks (Go/NoGo task; Gawrilow and Gollwitzer 2008): They either formed a goal intention to inhibit the response for marked stimuli ("I will not press a key for pictures accompanied by sounds") or additionally formed an if–then plan ("And if I hear a sound, then I will not press any key"). It was observed that children with ADHD who furnished a suppression goal with implementation intentions improved their inhibition of unwanted responses on a Go/NoGo task to the same level observed in children without ADHD.

Using the same task paradigm and self-regulatory conditions, Paul et al. (2007) measured electroencephalographic data of nonmedicated children with and without ADHD. They found that the formation of if–then plans not only improved response inhibition but also increased the NoGo-P300 in children with ADHD as compared to the baseline condition. As the NoGo-P300 represents the endogenous evaluation of response control and conflict monitoring, which are both reduced in children with untreated ADHD (Fallgatter et al. 2004), these findings suggest that such processes become more pronounced when children with ADHD employ if–then plans. Furthermore, recent studies have shown that children with ADHD also benefit from if–then plans with respect to more complex executive functions (e.g., task switching, inhibition of distractions; Gawrilow et al. 2011a). Finally, children with ADHD as well as children without ADHD waited longer for more precious rewards when they formed if–then plans beforehand rather than mere goal intentions (Gawrilow et al. 2011b).

Interestingly, in all of the studies investigating the effectiveness of if–then plans on executive function performance in children with ADHD, the benefits of those plans were particularly strong for children with ADHD as compared to children without ADHD. Apparently, forming implementation intentions alters cognitive, behavioral, motivational, and electrophysiological indices of performance on tasks that require self-regulation among children with ADHD. Note, however, that in all of these studies the experimenter suggested the if–then plans to children with ADHD, and that these if–then plans were geared towards eliciting the responses necessary for successful task performance.

The present study

We investigated whether teaching the strategy of mental contrasting with implementation intentions (MCII) to children at risk and not at risk for ADHD to be applied to their everyday lives for a period of 2 weeks would enhance their school-related self-regulation. Specifically, students in grades six and seven at risk and not at risk for ADHD were taught either a learning style alone or a learning style + MCII strategy. Two weeks after the intervention we assessed parental ratings of their children's self-regulation.

In line with the literature (e.g., Barkley 1997), we hypothesized that children with a higher risk for ADHD should show lower parent-rated self-regulation. We also assumed that parent-rated self-regulation in the learning style + MCII intervention condition should be higher than the parent-rated self-regulation in the learning style only condition. Importantly, as previous research revealed that if–then plans are particularly effective in children with ADHD (Gawrilow and Gollwitzer 2008; Gawrilow et al. 2011a), the effectiveness of MCII is assumed to be visible in children at risk for ADHD in particular. Thus, children at risk for ADHD should benefit even more from MCII compared to children without ADHD symptoms.

Method

Study design

The study followed a 2-between (Condition: learning style vs. learning style + MCII intervention) design and we randomly assigned participants to the two conditions. Participating children were classified as at risk for ADHD or not at risk for ADHD according to parents' ratings in the FBB-HKS scale (Rating Scale for Hyperactivity Disorder: scales measuring the ADHD core symptoms of inattentiveness, hyperactivity, and impulsivity; Döpfner and Lehmkuhl 2000; Döpfner et al. 2006). We used ADHD symptoms as a continuous variable.

The dependent variable was effective management of school-related activities as rated by children's parents, which was assessed 2 weeks after the intervention (via mail). Further background measures assessed in parents (via mail) were the Child Behavior Checklist (CBCL; Working Group German Child Behavior Checklist 1998) and sociodemographic data. In addition, participating children completed the Culture Fair Test (CFT-20; Weiß 1998).

Instruments

Symptoms of ADHD: FBB-HKS

The Questionnaire for Hyperkinetic Disorders (Fremdbeurteilungsfragebogen für das Hyperkinetische Syndrom, FBB-HKS) is taken from the Diagnostic System for Psychiatric Disorders in Childhood (DISYPS-KJ, Döpfner and Lehmkuhl 2000). This questionnaire allows the evaluation of hyperkinetic disorders or ADHD on the basis of the ICD-10 (WHO 1991) or DSM-IV criteria (APA 2000) with the assessment of the ADHD core symptoms (i.e., inattentiveness, hyperactivity, impulsivity). The questionnaire contains 20 items and measures both the severity of the symptoms (severity scale) and the degree of impairment caused by the symptoms (impairment scale) on a scale from 0 (not at all) to 3 (very much).

Emotional and behavioral adjustment: CBCL

Parents were asked to fill out the Child Behavior Checklist for children aged 4–18 (CBCL; Arbeitsgruppe Deutsche Child Behavior Checklist 1998) to verify the risk for ADHD and/or other psychological problems. The CBCL comprises a measure of children's emotional and behavioral adjustment, which is used to assess various aspects of children's behavior (e.g., anti-social and aggressive behavior in the externalizing scale, academic performance in the school competence scale).

Cognitive abilities: CFT-20

Participating children solved the Culture Fair Test (CFT-20; Weiß 1998) as an assessment of their cognitive abilities. Previous studies revealed a high loading of the CFT on a fluid intelligence factor indicating that this test has high validity as regards the concept of fluid intelligence (Cattell et al. 1973). The CFT can be applied as a group test to children and adolescents between the ages of 8.5 and 19 years. In our study we used the short version, which lasts approximately 35 min.

Socioeconomic status

To assess the socioeconomic status (SES) of the participating families we asked parents questions regarding their family income per month (i.e., ≤€1,500, ≤€2,500, ≤€4,000, or >€4,000) and their educational level (i.e., 9, 10, 12 or more years of school).

Management of school-related activities

Two weeks after the intervention we asked parents to rate their children's self-regulation. We operationalized self-regulation as effective management of school-related activities according to recent research targeting the academic responsibilities of adolescents (Duckworth et al. 2011; Duckworth and Seligman 2005). For item generation purposes, we conducted pilot interviews with ten parents and ten teachers of children diagnosed with ADHD. Parents and teachers considered the following five topics as the most problematic in the effective management of school-related activities of children with ADHD: homework, textbooks, desk, schoolbags, and vocabulary.

Based on the these interviews we asked parents to answer the following questions "*Homework is done reliably and independently*," "*Textbooks are clean and complete*," "*Workspace (i.e., desk) is tidy*," "*Schoolbags are packed independently*," and "*Vocabulary is learned.*" Questions were to be responded to on 10-point Likert scales (i.e., 1 = management of school-related activity is not at all effective to 10 = management of school-related activities is very effective).

Furthermore, to validate our five-item measure as a measure of self-regulation of goal pursuit in the area of management of school-related activities we invited parents ($N = 29$) with children attending grades five, six, seven, or eight, and asked them to complete the five items described above and to complete the Brief Self-Control Scale (BSCS, Tangney et al. 2004; German translation by Bertrams and Dickhäuser 2009). However, we also wanted to show that our measure does not relate to symptoms of ADHD. Therefore, we asked the parents to complete the FBB-HKS. All questions were asked regarding the child's behavior during the previous 6 months. Our measure of effective management of school-related activities (Cronbach's $\alpha = .86$) correlated positively with self-control (BSCS; $r = .31$, $p < .05$), but not with symptoms of ADHD (FBB-HKS total scale; $r = .09$, $p = .31$; the correlation between the inattention scale of the FBB-HKS and our measure of effective management of school-related activities was slightly higher, $r = .17$, but still not significant, $p = .15$). These findings suggest, that our measure of management of school-related activities is related to effective self-regulation in adolescents, but not to the occurrence of ADHD symptoms. In the main study, parents answered the five questions 2 weeks after the intervention. Like described above, the five questions measured management of homework, books, desk, schoolbags, and vocabulary. The items again showed high internal consistency (Cronbach's $\alpha = .87$).

Control items

We assessed expectations of both children and parents before the intervention and satisfaction of both children and parents after the intervention. Participants answered the following questions on scales from 1 (very low/not at all) to 7 (very high/a lot): "*How high are your expectations that after the intervention your (child's) self-regulation will improve?*" (before the intervention) and "*How satisfied are you with the changes that occurred as a result of the intervention?*" (after the intervention).

Participants

Boys and girls in the sixth and seventh grades were recruited from eight different local middle schools in Germany. As a first step in the recruitment process, we distributed leaflets containing information about our study on *Learning Style and Strategies* to students. Students were supposed to hand the leaflets to their parents. One hundred and sixty parents interested in participating with their children contacted us.

In the second step, the 160 parents who were interested were provided with further information about our study. We then asked them to complete (at home) a screening questionnaire assessing ADHD symptoms in their children (FBB-HKS; Döpfner et al. 2006) as well as to indicate the children's age, gender, previous ADHD diagnosis, current ADHD treatment of the child, and the family's ethnic background and SES. This screening questionnaire was completed and returned to us by 131 parents. Fifteen children were excluded from further participation in the study because they were either rated borderline in the manual of the FBB-HKS and/or were diagnosed with a psychiatric diagnosis by a psychiatrist (ADHD and/or another psychiatric disorder), and thus were prescribed psycho-stimulant medication and/or cognitive-behavioral treatments. With regard to ethnic background, all of the participating children were Caucasian and all families were native German-speaking.

Interventions

Students were randomly assigned to two conditions, to a learning style condition ($n = 56$) and to a learning

style + MCII ($n = 60$) condition. The learning style approach relates to the observation that learning is successful whenever the instructional method is aligned with the learner's individual learning style (e.g., an auditive learner benefits more from auditive than from visual instruction). Corresponding with this approach, over the last few years researchers identified various learning styles in children and tailored learning interventions to these individual differences in learning style (e.g., summary by Pashler et al. 2009). Thus, a prototypical learning style intervention would first classify participants into the various categories of learners [e.g., reflective or active learning types, for instance, in Honey and Mumford (2006); types that learn best from hearing a person talk about a topic or using mental images, for instance, in Dunn et al. (1984)] to then offer individualized ways of learning the materials. In Germany the learning style approach has been adopted widely in educational settings (i.e., schools, universities). Therefore, a learning style intervention seemed to be a reasonable control intervention for our study. Importantly, parents, children, and teachers were not informed of whether children received merely a learning style intervention or a learning style + MCII intervention.

Sessions were conducted by two female experimenters in a laboratory at a large university in Germany with groups of up to four children. The children first completed the Culture Fair Test (CFT-20; Weiß 1998) as a background measure and, after a break they received either the learning style or a learning style + MCII intervention.

Information for the parents

Parents were told: "*To effectively teach learning strategies we will assign children to various groups. In the case that a specific learning strategy is revealed as the most effective, we will offer all participants the opportunity to take part in a training session to learn this effective strategy.*" We could not exclude the possibility that children would tell their parents what they were taught during the intervention session. However, because the learning style intervention is widely used in schools in Germany, we assumed that even without MCII it will be accepted as an effective intervention.

Learning style intervention

The children had to recall items under four different conditions (i.e., reading words, looking at objects, listening to words, touching objects). At first, the experimenter presented ten different words (e.g., apple, pen, key) written on separate sheets of paper for 2 s, and asked the children to read these words carefully because the experimenter would ask them to remember the words later on. After a 30-s math filler task a prompt followed asking the children to write down all the words they remembered. This procedure was repeated with ten objects that were shown to the children, ten words that were read to them, and ten objects that were hidden in a cardboard box and needed to be touched. The children were told that the number of items they remembered during the four trials would represent a valid indicator of their learning style. A portfolio contained children's individual results from the learning style test and suggestions on how to best address their individual learning style (e.g., a child who is an auditive learner benefits from listening to vocabularies on tapes). The children were asked to apply the information on their learning style to their everyday school life in the upcoming 2 weeks.

Learning style + MCII intervention

In the learning style + MCII intervention condition participants first went through the learning style intervention and then were given an introduction to MCII, presented by the experimenters using power point slides and an LCD projector. Then the children received a booklet in which all steps of the MCII exercise were explained in detail, and asked to apply the MCII procedure to their most pressing academic concern that they felt they could resolve (i.e., high expectations of success; Duckworth et al. 2011; Gollwitzer et al. 2011; Stadler et al. 2009, 2010; see review by Oettingen, in press).

More specifically, based on previous work using MCII (review by Oettingen, in press; Oettingen et al., in press), the experimenter first asked the children to think about their most pressing school-related concern and to write it down (i.e., "*Your concern should be challenging for you, but you should be able to resolve it within the upcoming 2 weeks. If you have several concerns, select the one that is most important to you*"). We encouraged the children to choose a concern for which they perceived the chance of successful resolution was high because mental contrasting leads to particularly strong goal commitment when expectations of success are high (Oettingen et al. 2001). Next, the children were required to think of and write down the most positive outcome of successfully resolving their concern within the next 2 weeks. Then they had to imagine this most positive outcome vividly and write everything down that came to their mind concerning this outcome. Thereafter, the children were prompted to name the most critical obstacle that hindered them from achieving this outcome, to imagine this obstacle vividly, and to write down their respective thoughts and images. Finally, to teach the formation of implementation intentions, the experimenter prompted the participants to identify and write down the behavior necessary to overcome the identified obstacle. The participants then were told how to form

an if–then plan. The experimenter explained how to form sentences in the format of "*If the obstacle X occurs, then I will perform the specified behavior Y.*" After the children had formed and written down their if–then plan, they were asked to repeat the sentence to themselves three times. When this last step was completed, the children were thanked and were asked to apply MCII to their individual school-related concerns in the upcoming 2 weeks.

To provide an example, one student named as a concern: "*I would like to be more attentive in French class.*" The best outcome was "*to save leisure time*" and the obstacle was "*my friend Lisa distracting me.*" The child formed the following if–then plan: "*And whenever Lisa distracts me in French class, then I will say: No, please let us talk later.*" There was only one training session per child and each session took either 1 h (learning strategy only) or 1.5 h (learning strategy + MCII), including the assessment of the CFT-20.

Debriefing

After the parents had returned the completed questions regarding their children's effectiveness in managing school-related activities to the experimenter, they and their children received another letter in which they were extensively debriefed and thanked for their participation. A gift certificate was enclosed with the letter in appreciation of their efforts. Children in the mere learning style intervention condition were offered the opportunity to participate in an MCII intervention (without further measurement of the dependent variable). The study was approved by the responsible ethics committee and is compliant with the 1964 World Medical Association Declaration of Helsinki.

Results

Randomization check

There were no significant differences between the learning style and learning style + MCII conditions in the FBB-HKS inattentiveness severity scale, $t(114) = 2.24$, $p = .13$, inattentiveness impairment scale, $t(114) = 1.21$, $p = .27$, hyperactivity severity scale, $t(114) = 2.53$, $p = .11$, hyperactivity impairment scale, $t(114) = 2.19$, $p = .14$, impulsivity severity scale, $t(114) = 1.55$, $p = .21$, and impulsivity impairment scale, $t(114) = 1.81$, $p = .18$. (see Table 1). However, children in the learning style condition received marginally lower ratings on the total ADHD *severity* scale and ADHD *impairment* scale than children in the learning style + MCII condition; *t*s $(114) = 3.08$, $p = .08$ and $t(114) = 2.35$, $p = .12$.

Furthermore, there was no difference between children in the learning style and children in the learning style + MCII intervention condition regarding the CBCL externalizing, $t(114) = 1.11$, $p = .26$, attention problems, $t(114) = 0.66$, $p = .50$, and school competence scales, $t(114) = 0.27$, $p = .78$ (see Table 1). Also, the CBCL competence scores across domains (i.e., activities, social, school) of children in the learning style condition did not differ from those in the learning style + MCII condition, $t(114) = 0.91$, $p = .37$.

Finally, participants in the learning style ($M = 103.48$, $SD = 12.11$) and in the learning style + MCII intervention condition ($M = 106.23$, $SD = 11.65$) did not perform differently on the CFT-20, $t(114) = 1.24$, $p = .21$, there were no differences in family SES, and no differences in expectation and satisfaction ratings by parents and children either (see Table 1).

Management of school-related activities

We computed a hierarchical linear regression analysis entering ADHD symptoms as a continuous predictor (mean centered) and Condition as a categorical predictor in the first step and the interaction term of ADHD symptoms X Condition entered in the second step. Management of school-related activities as rated by the parents was the dependent variable. In the final model, which included Step 1 and Step 2, ADHD symptoms ($\beta = -1.36$, $p < .001$), Condition ($\beta = -0.39$, $p < .05$), and the ADHD symptoms X Condition interaction ($\beta = 1.15$, $p < .05$) were significant predictors. The model explained 15 % of the variance in self-regulation ratings (adjusted R^2).

As we had hypothesized, parents rated their children's management of school-related activities worse when children showed more ADHD symptoms. In addition, children in the learning style condition ($M = 5.53$, $SD = 2.13$) received lower parent-rated management of school-related activities than children in the learning style + MCII intervention condition ($M = 5.87$, $SD = 2.12$). Finally, we had hypothesized a steeper positive relation between ADHD symptoms and parent-rated management of school-related activities in the learning style + MCII intervention condition than in the learning style only intervention condition. One way to probe significant interaction terms in regressions involving categorical and continuous variables is "to test whether the predicted values for any pair of the groups differ at a specified value of the continuous variable" (Aiken and West 1991, p. 132). Thus, when probing the significant interaction by comparing regression lines at specific points (i.e., ∓ 1 SD of the mean of ADHD symptoms), we found that as ADHD symptoms increased, the slope regarding the management of school-related activities became more strongly positive in the MCII intervention condition, whereas this was not the case for the learning style intervention condition. This lead to a non-significant slope difference of—0.13 at -1 SD of the mean

Table 1 Characteristics of the sample by intervention condition

Variables	Conditions		Group
	MCII ($n = 60$)	Learning style ($n = 56$)	Differences p value
Age in years			
Mean age (SD)	12.57 (0.87)	12.58 (0.92)	.97
Gender			
Boys (%)	71.7	62.5	.29
FBB-HKS			
Mean inattentiveness severity (SD)	1.44 (0.67)	1.26 (0.59)	.13
Mean inattentiveness impairment (SD)	1.38 (0.70)	1.24 (0.65)	.27
Mean hyperactivity severity (SD)	0.61 (0.72)	0.43 (0.50	.11
Mean hyperactivity impairment (SD)	0.51 (0.64)	0.35 (0.49)	.14
Mean impulsivity severity (SD)	0.79 (0.80)	0.62 (0.66)	.21
Mean impulsivity impairment (SD)	0.62 (0.70)	0.46 (0.62)	.18
Total ADHD-severity (SD)	1.02 (0.62)	0.84 (0.45)	.08
Total ADHD-impairment (SD)	0.92 (0.58)	0.77 (47)	.12
Behavioral ratings (CBCL)			
Externalizing problems T value (SD)	56.16 (9.40)	54.39 (7.51)	.26
Attention problems T value (SD)	61.58 (9.18)	60.51 (7.93)	.50
School competence T value (SD)	40.68 (6.71)	40.32 (7.37)	.78
CFT-20			
Mean IQ (SD)	106.23 (11.65)	103.48 (12.11)	.21
Family income (SES)			
Between €1,500 and €4,000 (%)	71.7	73.2	.86
Highest education level (SES)			
≤10 years of school (Mothers, %)	85.0	85.8	.85
≤10 years of school (Fathers, %)	71.7	69.7	.97
Expectations (before intervention)			
Children	5.10 (1.08	4.87 (1.11)	.27
Parents	4.78 (1.32)	4.41 (1.31)	.14
Satisfaction (after intervention)			
Children	3.54 (1.60)	3.61 (1.66)	.82
Parents	2.71 (1.23)	2.50 (1.30)	.37

Family income was reported according to the following options: 1 = below €1,500, 2 = below €2,500, 3 = below €4,000, 4 = more than €4,000, FBB-HKS = ADHD questionnaire from the Diagnostic System for Psychiatric Disorders in Childhood, CBCL = Child Behavior Checklist, CFT-20 = Culture Fair Test, SES = Socioeconomic Status

of ADHD symptoms ($p = .36$) and to a significant slope difference of 0.28 at +1 SD of the mean of ADHD symptoms ($p < .05$).

Control analyses

We included performance on the CFT as an additional term in our regression model. However, including the CFT score did not explain more of the error variance in the model, and furthermore the term was not significant ($p = .81$). Hence, the effect of MCII seems to be independent of cognitive performance potential as measured by the CFT. Moreover, we included parents' and children's expectation and satisfaction ratings as additional terms in our regression model. However, including these variables did not explain more of the error variance in the model, and the items did not significantly predict the parent-rated management of school-related activities either (all $ps > .47$). Thus, the effect of MCII seems also to be independent of parent-rated and child-rated expectations as well as parent-rated and child-rated satisfaction with the intervention.

Discussion

Self-regulation of school-related goal pursuit in children at risk for ADHD improved after an intervention that targeted both goal setting and goal implementation, mental contrasting with implementation intentions (MCII). Moreover, MCII as compared to a learning style only strategy raised the self-regulation levels in children more, the more ADHD symptoms children showed. Thus, engaging in MCII enables children at risk for ADHD to enhance their self-regulation.

It is important to note that the learning style + MCII intervention was very time and cost effective as children received only one training session. Our finding is in line with both the mental contrasting and the implementation intention theories. Mental contrasting creates strong and stable goal commitments, and implementation intentions lead to the automatic initiation of goal-directed actions. It is no longer necessary, therefore, for the interventionist to keep reminding students of their set school-related goals and their plans for how to implement these goals (e.g., Johannessen et al., in press).

Implications for ADHD research

Although many schoolchildren are considered to be in the borderline range of ADHD (i.e., 4.9 % in a recent German study), little research exists concerning the effects of self-regulation interventions for children at risk for ADHD (DuPaul and Stoner 2003). The present study extends previous research that already showed the beneficial effects of implementation intentions in children with ADHD (e.g., Gawrilow and Gollwitzer 2008; Paul et al. 2007). This is because we demonstrated the effectiveness of a self-regulation intervention that (a) entails two complementary self-regulation strategies (goal setting by mental contrasting plus goal striving by implementation intentions), (b) works best for children with stronger risks for ADHD, (c) entails the application of these strategies in an applied setting, and (d) shows effects after a time period of 2 weeks. We observed that in schoolchildren the effect of using these strategies resulted in an improvement of the management of everyday school-related activities and not just on the performance on an assigned executive function task.

Further research should explore how academic self-regulation strategies can be taught optimally to children at risk for ADHD in the context of the classroom. In other words, how can teachers instruct their students to use MCII to improve their school-related activities and performances? Answering this question is important because children with special educational needs (i.e., learning disorders, dyslexia, ADHD) have to receive additional supervision within their schools and standardized evidence-based programs rarely exist for children at risk for or with ADHD (Lauth and Naumann 2009).

Implications for educational research

The findings of our study imply that teachers can encourage their students to mentally contrast their school-related concerns and to form implementation intentions. As a first step, students can be induced to think about desired outcomes associated with successfully resolving their concerns as well as aspects of present reality that impede the fulfillment of their concerns (i.e., obstacles). As a second step, teachers can support the formation of implementation intentions by encouraging their students to link the discovered obstacles to goal-directed actions in an if–then format. If MCII is practiced by applying it to a number of different concerns, it can become a meta-cognitive strategy for setting and implementing goals that enhances self-regulation in the classroom context in general—the benefits are no longer limited to the one concern to which MCII was applied to in the first place. Accordingly, teachers may practice MCII with their students by involving different concerns relating to different topics and subjects; this should habitualize its use and guarantee its transfer to all types of concerns (Johannessen et al., in press).

That parents and children did not evaluate the intervention as fulfilling their expectations speaks to the automation hypothesis and is in line with implementation intention theory (Gollwitzer 1999). If–then plans are assumed to lead to an automatic activation of behavior without the need for conscious control. This is because two important mechanisms for implementation intentions become effective (i.e., the heightened accessibility of the cue and the automatic activation of the intended behavior in the presence of the critical cue), which have been shown to mediate the effects of if–then plans on behavior (e.g., Webb and Sheeran 2007). In the same vein, recent research shows that the effects of mental contrasting are also produced by automatic processes (Kappes and Oettingen 2012; Kappes et al., in press). Thus, by taking advantage of this automation and taking into account the special features of the classroom context, it might be possible to develop a highly effective classroom-based MCII self-regulation intervention.

Limitations of the present study

The present study has several shortcomings. Most importantly, we categorized participants into children at risk and not at risk for ADHD according to parental ratings in a diagnostic questionnaire rather than through an examination by a trained professional. Therefore, we cannot conclude that participants in the group of children considered at risk for ADHD necessarily would receive a clinical ADHD diagnosis, or that participants in the group of children considered not at risk for ADHD would not. However, to group children at risk and not at risk for ADHD on the basis of parents' indications is commonly used, valid, and reliable. Indeed, the ADHD questionnaire (Döpfner et al. 2006) was validated by the administration of a second questionnaire (CBCL). Thus, we can infer that the children we classified as at risk for ADHD suffered from attention and/or behavior problems that jeopardized their academic achievement (even though they might not

receive the full-scale diagnosis of ADHD). Therefore, our findings can be interpreted as showing that an MCII intervention benefits children with self-regulatory problems that are manifested in a risk for an ADHD diagnosis.

In the present study, we assessed the main dependent variable 2 weeks after the interventions without taking a baseline measurement before the learning style and MCII interventions were conducted. Thus, one might wonder whether the children in the two different intervention conditions (learning style vs. learning style + MCII) differed according to their parent-rated management of school-related activities to begin with. However, when comparing CBCL ratings between the two intervention groups immediately prior to the interventions, no differences emerged between the learning style and learning style + MCII conditions, attesting to successful randomization. Next to the externalizing and attention scales, the same lack of a difference held true for the competence scores across domains (i.e., activities, social, school).

In the present study, we also used parental ratings of the children's management of school-related activities as an outcome measure to determine the efficacy of the MCII intervention rather than more objective dependent measures such as teacher evaluations. However, as ADHD-related behaviors (i.e., inattentiveness, hyperactivity, impulsivity) are hard to handle in the classroom context, children with ADHD often suffer from poor relationships with their teachers—which may lead to a child receiving a biased rating from his or her teacher. Indeed, a recent study revealed that some children require more effort to teach than other children (Houts et al. 2010). Interestingly, the children's most challenging behaviors corresponded with the three core symptoms of ADHD (i.e., inattentiveness, hyperactivity, impulsivity). Thus, it can be assumed that children at risk for ADHD require more effort from their teachers, which in turn might negatively bias teacher ratings. Finally, most of the criteria by which we asked parents to assess their children's school-related management of school-related activities (i.e., "*Homework is done reliably and independently*," "*Textbooks are clean and complete*," "*Workspace is tidy*," "*Schoolbags are packed independently*," and "*Vocabularies are learned*") can be evaluated better by parents than by teachers.

We also did not observe participants' behavior over a period of time longer than 2 weeks. Further research could track children over a school year to measure long-term effects of the MCII self-regulation intervention. This approach seems to be promising as recent studies found remarkable long-term effects from MCII interventions (i.e., up to 2 years after the intervention session; Stadler et al. 2010).

Another limitation exists in the type of conditions we compared in the present study—a learning style intervention against a learning style + MCII intervention containing two complementary self-regulatory strategies (i.e., mental contrasting and implementation intentions). From a goal setting and goal implementation perspective one might want to ask whether the effects were caused by mental contrasting alone, implementation intentions alone, or the combination of these strategies. Therefore, future studies might want to include separate mental contrasting and implementation intention conditions along with the control and MCII conditions. However, recent research shows that MCII interventions are superior to mere mental contrasting or mere implementation intention interventions. The latter two both show significantly weaker effects alone than when integrated into an MCII intervention (Adriaanse et al. 2010; Kirk et al., in press).

Conclusions

In the present intervention study the strategy of mental contrasting with implementation intentions (MCII) proved to be a cost- and time-effective way of improving self-regulation in children at risk for ADHD. The findings imply that mental contrasting (by promoting strong goal commitment) and forming implementation intentions (by promoting effective goal striving) complement each other to help children master their challenges of their everyday lives. The conditions under which MCII can be taught optimally and used over longer periods of time should be investigated in future research, as should the transfer effects of MCII beyond the academic domain such as its effects on children's well-being and the quality of their interpersonal relationships.

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