

What Works for Whom, How and under What Circumstances? Testing Moderated Mediation of Intervention Effects on Externalizing Behavior in Children

Sabine Stoltz, Maja Deković, Monique van Londen,
Bram Orobio de Castro and Peter Prinzie, *Utrecht University*

Abstract

In this study, we investigate whether changes in child social cognitive functioning and parenting are the mechanisms through which an individually delivered real-world child intervention, Stay Cool Kids, aimed at preventing externalizing problem behavior in high-risk elementary school children, induces changes in child behavior. Moreover, we tested whether mediation was moderated by child characteristics (gender and personality). The sample consisted of 264 fourth-grade children displaying externalizing behavior (TRF t-score > 60). Forty-eight schools were randomly assigned to the intervention or no-intervention control condition. The results of mediation analyses provided evidence for child positive self-perception and maternal involvement as working mechanisms of the intervention. Child personality factor extraversion moderated the mediating effect of involvement whereas no moderated mediation was found for gender. Working mechanisms of the intervention differ for children with different personality characteristics.

Keywords: moderated mediation; reactive and proactive aggression; social information processing; self-perception

Introduction

The vast majority of the studies that evaluated the effects of child interventions in reducing externalizing behavior are efficacy trials, in which the effects of interventions are examined under ideal conditions (i.e., highly controlled settings, with groups of carefully selected individuals). Although highly important, these studies do not represent adequately the more complex reality of child mental health care services, with less structured care and heterogeneous groups of children. Recently, there has been more interest in effectiveness trials in real-world settings (e.g., schools), delivered by regular service staff (Weisz, Sandler, Durlak, & Anton, 2005).

Correspondence should be addressed to Sabine Stoltz, Department of Child and Adolescent Studies, Utrecht University, P.O. Box 80.140, 3508 TC Utrecht, The Netherlands. Email: s.e.m.j.stoltz@uu.nl

Despite the fact that many trials measure potential mediators, mechanisms through which ameliorative effects are exerted have rarely been empirically tested (Hinshaw, 2002). Especially in effectiveness trials, it is important to know what the critical ingredients of an intervention are. Therefore, the first goal of the current study is to examine mediators of intervention effects within a randomized controlled trial conducted under real-world conditions (in schools, delivered by regular service staff). In this study, we investigate whether changes in child social cognitive functioning and parenting are the mechanisms through which an individual child intervention, Stay Cool Kids, aimed at preventing externalizing problem behavior in high-risk elementary school children, induces changes in child aggressive behavior. The intervention was found to be moderate effective across informants in reducing reactive and proactive aggression. Clinically relevant changes in externalizing behavior were reported for children who received the intervention. Moreover, several aspects of social information processing improved after the intervention, and children had a more positive self-perception (Stoltz, van Londen, et al., 2012). In the current study, we conduct mediator analyses to elucidate the working mechanisms of the intervention.

There are several reasons to focus on child's social cognitive functioning as a mechanism that can explain the effect of a child intervention on aggressive behavior. Firstly, the intervention under investigation in the present study, Stay Cool Kids, is an indicated individually delivered preventive intervention, based on a social cognitive perspective, which can be tailored to child's specific needs. Proposed effective program components and strategies are intent attribution retraining, perspective taking, awareness of emotions, anger regulation, positive self-perception, goal setting, generating prosocial alternatives for aggressive behavior, and problem solving skills, which are all based on the assumption that aggressive children display distortions in their social cognitions (Kruuk & Hudepohl, 2007).

Secondly, a body of research suggests that child social cognitions are central to child behavior. According to the social information processing model (Crick & Dodge, 1994; Lemerise & Arsenio, 2000), behavior can be seen as a product of six mental steps: (1) encoding of social cues, (2) interpretation of encoded cues, (3) clarifying goals, (4) generating responses to meet goals, (5) selecting responses, and (6) enacting the selected response. Systematic deviations in each of these steps have been found to lead to aggressive behavior. More particular, at the encoding stage, children with aggressive behavior tend to base interpretations of social events on fewer cues, recall more threatening cues, and are more likely to rely on their memory instead of paying attention to new information (Dodge & Coie, 1987). With respect to the interpretation of encoded cues, aggressive children interpret ambiguous peer provocations as hostile (Lochman & Dodge, 1994). Next, aggressive children often define their goals for obtaining desired (instrumental) outcomes without looking after consequences (Crick & Dodge, 1994). They generate more aggressive responses and are more likely to opt for aggressive solutions in social conflict situations because they expect that it is more effective in obtaining desired outcomes (deviant outcome expectations) (Matthys & Lochman, 2005). Deficits in each of these steps have been found to be related to different forms of aggressive behavior. Children who have difficulties with encoding and interpreting cues in a non-hostile way and who consequently generate more aggressive response often show *reactive* aggression, which is an angry, emotional reaction to a presumed threat or provocation (De Castro, Merk, Koops, Veerman, & Bosch, 2005; Dodge, 1991). Children who select aggressive responses and enact aggressive behavior to meet their goals are displaying mainly *proactive* aggression,

which is planned aggression to dominate or intimidate (De Castro et al., 2005; Dodge, 1991). Moreover, aggressive children seem to differ in the level of self-esteem, although deviations are not entirely clear. On the one hand, it has been found that low levels of self-esteem are related to externalizing problems (Donnellan, Trzesniewski, Robins, Moffitt, & Caspi, 2005), but on the other hand, it is suggested that an unrealistic high self-esteem, rather than low self-esteem, contributes to externalizing (mainly proactive aggression) behavior (e.g., De Castro, Brendgen, van Bostel, Vitaro, & Schaeppers, 2007).

A final reason to focus on social information processing and positive self-perception is because several studies have shown that cognitive behavioral interventions for children indeed have positive effects on child social cognitive functioning (e.g., Coping Power Program; Lochman, Burch, Curry, & Lampron, 1984; Fast Track Intervention; McMahon et al., 1999). Moreover, so-called social information processing interventions, which explicitly provide training on one or more of the social information processing steps, seem to be effective in reducing aggressive behavior in high-risk school-aged children (Wilson & Lipsey, 2006). However, in this meta-analysis, it is not tested whether the social information components indeed are the working mechanism that may explain the effectiveness of these interventions. Therefore, because of limited evidence available, it is still possible that the effectiveness of these interventions has little to do with the theoretical model upon which the interventions are based. In their review on mechanisms of action in youth psychotherapy, Weersing and Weisz (2002) give an example of cognitive behavioral therapy for youth depression. Cognitive behavioral techniques, with the aim to remediate cognitive distortions, are often proposed as working mechanisms of these interventions. Although the interventions are successful in reducing depression, there was only one study that *tested* whether changes in cognitive distortions resulted in changes in behavior. This study did not find evidence for mediation (Kolko, Brent, Baugher, Bridge, & Birmaher, 2000).

In the current study, we also test whether changes in parenting behavior, more specifically changes in maternal involvement and overreactivity, mediate intervention effects. The reason to include parenting behavior as potential mediator of intervention effects of a *child* training is that the Stay Cool Kids intervention can be seen as a contextual intervention. This means that parents are involved in the training as well. There are three meetings with the child's trainer, parents receive written information after each training session, and parents are asked to practice exercises of the child training together with their child at home. Cross-contextual interventions are supposed to result in better generalization and maintenance of changes in child behavior (Prinz, Blechman, & Dumas, 1994). Although changing parenting behavior is not a goal of the current intervention, parenting behavior may change because of the involvement of parents in the training, which in turn may lead to a change in child behavior. Many studies found that parenting has a significant impact on child aggressive behavior. Negative discipline, such as overreactive parenting, is associated with conduct problems in children (e.g., Snyder, Cramer, Afrank, & Patterson, 2005) whereas positive parenting, such as involvement, is associated with less aggression (Wissink, Deković, & Meijer, 2004). Some intervention studies indeed found that child intervention to reduce aggression in children resulted in a (small) change in parenting behavior as well (e.g., Webster-Stratton & Hammond, 1997). However, whether changes in parenting behavior also mediate intervention effects of a child training has been examined less often.

A second goal of the present study is to examine whether mediational processes are influenced by moderators. More specifically, working mechanisms of an intervention can differ as a function of specific child characteristics, such as gender and personality. Very few intervention studies tested this ‘moderated mediation’. In a study on the effects of a preventive intervention for children of divorce, it was found that initial level of problem behavior moderated mediation effects (Tein, Sandler, MacKinnon, & Wolchik, 2004). Mediation effects of mother–child relationship quality on internalizing problems were primarily found for children who started the intervention with more problems in the mother–child relationship, discipline, and externalizing behavior. In previous studies on effectiveness of Stay Cool Kids, we found moderation of intervention effects by child personality and gender (Stoltz, van Londen, et al., 2012; Stoltz, Prinzie, et al., 2012). Children with specific personality traits (low extravert and high conscientious) and boys benefited more from the intervention on some of the outcome behaviors. Therefore, in the current study, we tested whether working mechanisms of the intervention are also dependent on these moderators.

In sum, the aims of the present study are to test (1) whether social information processing, positive self-perception, and parenting are mediators of an intervention delivered under real-world circumstances; and (2) whether mediation is moderated by child characteristics. Based on the theoretical model and the contextual basis of the intervention, we expected that the effectiveness of Stay Cool Kids on reactive and proactive aggression would be explained by intervention-induced changes in child social-information processing, self-perception, and changes in overreactive parenting and maternal involvement. Because, to our knowledge, previous intervention studies did not include gender or personality as moderators of mediation effects of an intervention, the moderated mediation analyses are exploratory.

Method

Design

A randomized controlled trial design was used with 48 elementary schools in The Netherlands, randomly assigned to the intervention or control condition. Each school (fourth-grade classes) participated in the intervention condition, as well as in the control condition. In this way, schools were more willing to participate in the control condition, and treatment condition was randomized in such a way to ensure that intervention effects could not be due to school factors. However, randomization at school level could possibly lead to biased results. To examine whether the nesting of children within schools affected results, we computed the design effect (Muthén, 2000). This is expressed as $d = 1 + \rho(c-1)$, where ρ is the average intraclass correlation (.28), and c is the common cluster size (i.e., average number of children per school, 4.2). The design effect was 1.90, which is smaller than 2.0 and can therefore be ignored.

There were two assessment periods: prior to the beginning of the intervention and at intervention termination (after 11 weeks). Dependent measures were individually administered to children in their school settings by trained research assistants. Teachers and mothers received questionnaires and were asked to return these within a week. The study was approved by the Dutch Central Committee on Research Involving Human Subjects.

Participants

In agreement with demands of the Dutch Central Committee on Research Involving Human Subjects, first parents of all children in the class were asked to give teachers permission to possibly fill out a questionnaire about their child. This was active consent; parents had to sign a consent form. In some classes, parents did not return consent forms. In those cases, teachers asked explicitly for consent forms only for those children that he/she indicated as being externalizing. After obtaining parental consent, fourth-grade teachers nominated children from their classes with the highest levels of externalizing behavior (the top 30%) and filled out the 32-item externalizing scale of the TRF (Achenbach, 1991; $n = 437$ children). In a letter, it was explained to teachers what externalizing behavior looked like (disobedience, aggression, lying, and fighting). The same procedures were used in studies on the Coping Power Program (Lochman & Wells, 2002). Next, researchers selected children based on their t -scores. The inclusion criterion was a t -score > 60 , indicating a (sub) clinical level of externalizing behavior (mean t -score = 67.49 (5.58), range from 60 to 89), which places children at risk for various negative outcomes. Some children that were nominated by teachers did not meet the inclusion criterion of t -score > 60 ($n = 96$). If children ultimately were found to have high levels of externalizing problems, parents were contacted again to give final permission for participating in the intervention or in the no-intervention control group. In total, 52 parents refused to allow their child to participate (12%). There were no differences on demographic variables for those children whose parents refused to participate and those who did not. Some children already participated in other forms of youth mental health care for their behavioral problems ($n = 15$), or they were diagnosed with autism spectrum disorder ($n = 3$) and therefore could not participate in this study. After consent was obtained, the baseline pre-assessment was conducted. Three children discontinued the child intervention (because of more serious behavioral problems and referral to therapy, and lack of motivation of the child), and four children discontinued in the control condition (because of moving to a different city, quit school). Figure 1 presents a flow chart of the randomization process.

The final sample consisted of 264 children [72% boys; $M_{\text{age}} = 10.2$ years, standard deviation (SD) = 60], their teachers ($n = 155$) and mothers ($n = 197$) at time 1. From these children, 191 participated in the intervention condition, and 73 participated in the control condition. Teachers filled out questionnaires about child personality for all children (some teachers filled out questionnaires for more than one child) only at time 1. For mothers, missing data at time 1 ($n = 67$) and time 2 ($n = 93$) were completely random (Little's missing completely at random test: $\chi^2/7 = .99$, $p = .44$). Therefore, we decided to use multiple imputation techniques module of LISREL 8.7 (Jöreskog & Sörbom, 2004) with the expected maximization (EM) algorithm. Imputed data were used in further analyses.

There were no significant differences in gender or Teacher Report Form (TRF; Achenbach, 1991) score for those children and parents who consented to participate and those who did not. Children in the intervention and control group did not differ significantly on demographic characteristics (socioeconomic status, ethnic background). Children in the control condition did not receive any intervention or received care as usual (e.g., remedial teaching and universal remediation programs). Moreover, the Stay Cool Kids intervention is offered to children in the control condition after the final assessment when still necessary (a year after treatment termination).

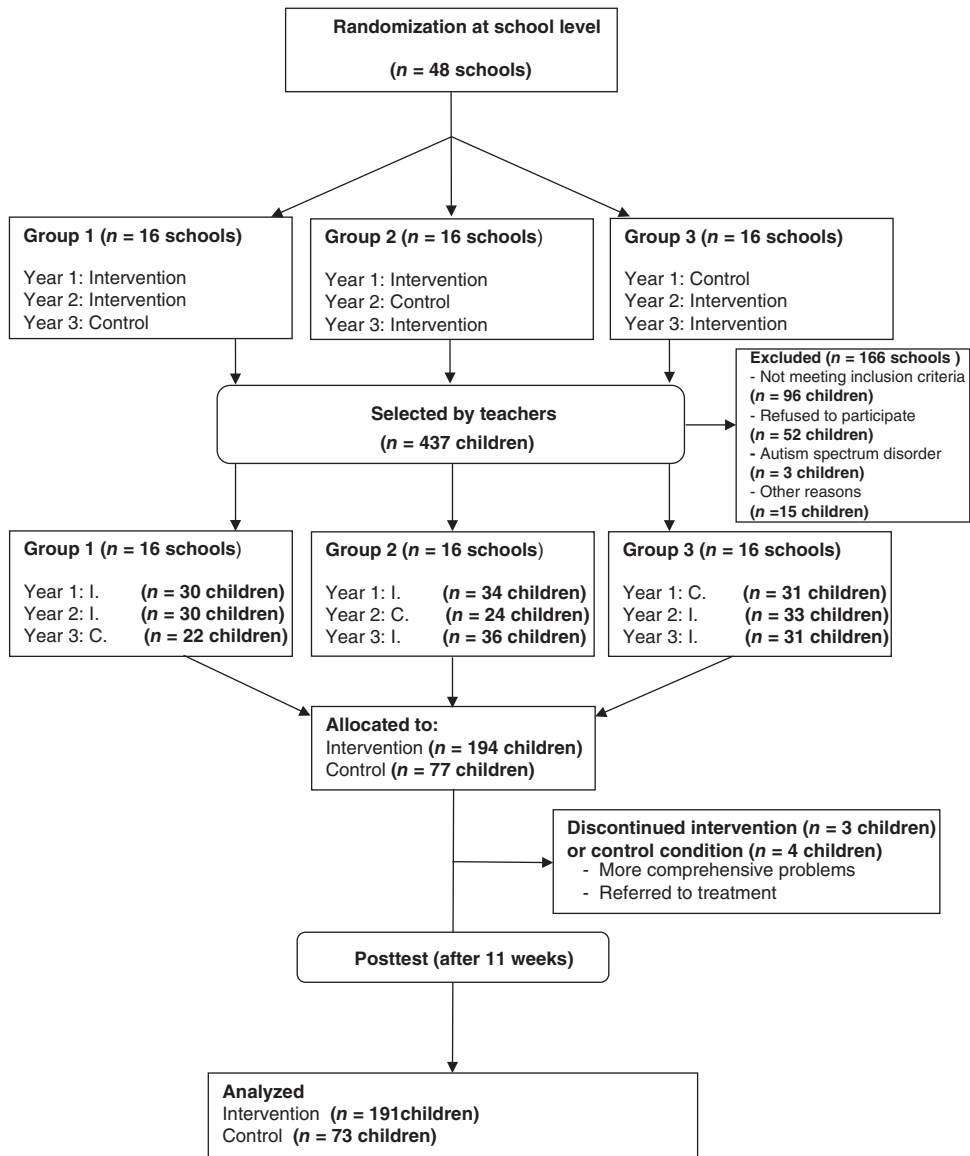


Figure 1. Flow Chart of Randomization Design.

Intervention 'Stay Cool Kids'

The Stay Cool Kids training is a social cognitive intervention that focuses on reciprocal relations between cognitions, emotions, and behavior of the child. The training is designed to reduce aggressive behavior in highly aggressive children at elementary schools. The long-term goal is to prevent the development of externalizing behavior disorders. We recently reported short-term effects in reducing externalizing behavior problems and in changing social cognitive functioning among fourth-grade school children (Stoltz, van Londen, et al., 2012). Trainers worked individually with the target child in 8 weekly sessions of 45 min. Children were seen during the school day from

January until March. The trainer met with parents and teachers before the start of the training, during a midterm evaluation, and at the end of the training.

The training consisted of two phases. In the first phase, trainers investigated the child's specific needs and competences. The first session starts with a general introduction, which is the same for all children. Next, trainers were able to choose two from six exercises, which were best suited for the individual child, for the second and third sessions. After the third session, an individual analysis of child's competences was made and discussed with parents and teachers during a midterm evaluation, resulting in an individual intervention plan. For the intervention plan, trainers chose five from nine program components, which were most appropriate for the individual child's needs, as described in the trainer manual. There are exercises that focus on children having a more positive, but realistic, self-perception (e.g., exercise 'up and down': the trainer teaches the child to think more positive and to change negative thoughts into positive thoughts). Other exercises focus on changing hostile intent attribution and response generation (e.g., exercise 'traffic light': children are learned not to react impulsive and aggressive but to choose for an assertive response). Exercises that focus on anger regulation use, for example, the 'anger-thermometer' in which children become aware of their feelings and in turn do not respond impulsively on social situations. Finally, there are exercises that focus on less aggressive and more prosocial behavior and use, for example, the 'yellow-cap' in which children learn to react with an assertive or more prosocial response rather than with an aggressive response. Before phase 2 (sessions 4–8) started, a contract between the trainer and the child was signed, in which the training program is described. Parents and teachers received written information after each training session about what was done during the training. Also, they were asked to practice together with the child its newly learned skills.

Treatment Fidelity

In this study, an existing intervention is evaluated, and participating Stay Cool Kids trainers ($n = 33$) from youth mental health care centers are providers of the intervention within these schools. Trainers have a background in clinical child psychology and have to be certified as a Stay Cool Kids trainer. To become certified, trainers have to run three pilot trainings, under supervision from accredited Stay Cool Kids trainers. These initial pilot trainings were prior to the present research, and these trained children were not included in the study. During the intervention period for this study, trainers had two-weekly meetings to discuss trainings and acquire feedback from other trainers and supervisors. Trainers filled in logs after every intervention session. Logs completed by the trainers indicated that 99% of the trainings were completed as planned. The average training session lasted 45 min. Trainers changed the content of their training session in 6.5% of the cases, when the planned training session did not work for the specific child. Overall, it was found that Stay Cool Kids was conducted as intended. From logs, it can be concluded that in 65% of the trainings parents and trainers were in contact during the intervention via mail and home exercises.

Measures

Outcome Variables

Aggressive behavior. The teacher rating of aggression (TRA; Dodge & Coie, 1987; Hendrickx, Crombez, Roeyers, & Orobio de Castro, 2003) was used to measure

teacher-reported reactive and proactive aggression. An adapted child version of the TRA was used to measure child-reported reactive and proactive aggression. Reliability, factor structure, and validity of the TRA are adequate (e.g., De Castro et al., 2005; Hendrickx et al., 2003). Items for reactive (e.g., 'When I am/this child is teased or threatened, I/he or she get(s) angry easily and strike(s) back'; three items) and proactive aggression (e.g., 'I/this child use(s) force to dominate peers'; three items) were rated on a 5-point Likert scale (1 = never to 5 = always). (Cronbach's alphas teacher-reported reactive aggression T1 = .82, T2 = .85 and proactive aggression T1 = .79, T2 = .87; Cronbach's alphas child-reported reactive aggression T1 = .50, T2 = .60 and proactive aggression T1 = .71, T2 = .75).

Mediator Variables

Positive self-perception. To assess positive self-perception, children were asked to fill out the subscale 'behavior attitude' of the Dutch version of the self-perceived competence scale for children (Harter, 1982; Veerman, Straathof, Treffers, Van den Bergh, & Ten Brink, 1997) (e.g., 'Some kids usually get in trouble because of the things they do; Other kids don't do things that get them into trouble'). Children first had to decide which of the items in the pair better described them, and then they had to choose between 'sort of true' or 'really true'. With this format, the effects of a pull for social desirability are reduced (T1 α = .68, T2 α = .73). Higher scores indicate a more positive self-perception.

Social information processing. Four hypothetical stories were presented to children (social information processing test; De Castro et al., 2005). The stories all concerned being hindered by a peer whose intentions are ambiguous (e.g., "Imagine: You and a friend are taking turns at a game at the pin-ball machine. When one has lost the game, it is the other's turn. Now it's your turn, and you are doing great. You will soon earn an extra ball, so you are trying very hard! The boy/girl you are playing with watches the game over your shoulder. He looks into the pin-ball machine to see where the ball is. Then he shouts 'Watch out! The ball will drop from the right side!' But all of the sudden the ball appears from the left side and now you have lost the game!").

Hostile intent. Immediately after hearing a story, the child was asked to indicate why the peer in the story might have acted the way he or she did. Responses were written down by the interviewer and scored as 0 (*benign intent*) or 1 (*hostile intent*). Some children answered the question with an either-or response. When children generated more than one response, they were asked what they thought was most likely in the specific situation. Mean kappa was calculated to measure intercoder agreement, which was .95 to 1.00. Disagreements were resolved through discussions until consensus was reached. An open-answer hostile attribution variable was created by counting the number of stories with hostile answers (from 0 = *never a hostile attribution* to 4 = *always a hostile attribution*). Furthermore, the child was asked to indicate the peer's intent on a 10-point rating scale ranging from 1 = to be *nice* to 10 = to be *mean*. Scores were averaged over the four stories. Because the open-answer and rating-scale variables were strongly correlated ($r = .74$), they were combined by standardizing each variable and then by computing their average.

Response generation. Next, children were asked what they would do when the events in the vignette would actually happen to them. Responses were written down by the interviewer and scored 0 (*not aggressive*), 1 (*verbally aggressive or coercive response*), 2 (*physically aggressive response*), and scores were averaged over the vignettes. In a previous study (De Castro et al., 2005), findings showed that an accurate interval scale of response aggressiveness could be created by weighting physical aggression with two points, verbal aggression with one point, and non-aggression with zero points. Inter-rater's agreement was found to be high (95%).

Approval of aggression. Next, a possible behavioral response to the problem was presented (e.g., 'if this happens to me, I will hit the child who pushed me'). The child had to indicate on a 10-point scale whether he or she thought that this was a good response (0 = *not a good response* to 10 = *a good response*). Ratings were averaged over the stories.

Enactment of aggression. Children similarly had to indicate on a 10-point scale to what extent they would enact a presented aggressive response themselves.

Parenting

Maternal involvement. The Alabama parenting questionnaire (Elgar, Waschbusch, Dadds, & Sigvaldason, 2007) was used to measure maternal involvement (10 items, e.g., 'I have a friendly talk with my child', Cronbach's alpha T1 = .70, T2 = .71). On a 5-point rating scale (from 1 = *never* to 5 = *always*), mothers were asked how much they agreed with statements.

Overreactivity. The parenting scale (Arnold, O'Leary, Wolff, & Acker, 1993; Prinzie, Onghena, & Hellinckx, 2007) was included to assess overreactive parenting using a 7-point Likert scale (seven items, e.g., 'When my child misbehaves: I raise my voice or yell', Cronbach's alpha T1 = .80, T2 = .79).

Moderator variables

Gender. Gender (0 = boy and 1 = girl) was coded as a dichotomous variable.

Personality. Teachers rated about child personality characteristics using the hierarchical personality inventory for children (HiPIC; Mervielde & De Fruyt, 1999). The HiPIC is a comprehensive personality inventory that assesses individual differences of children in 144 items. It has shown to have high convergent and discriminate validities, temporal stability, and replicability (Mervielde & De Fruyt, 2002; Shiner & Caspi, 2003). The items are on a 5-point scale, ranging from 1 = *almost not characteristic* to 5 = *very characteristic* (e.g., 'accepts authority'). The number of items and Cronbach's alphas for each dimension were extraversion (32 items, .92 for extraversion), benevolence (40 items, .85), conscientiousness (32 items, .93), emotional stability (16 items, .87), and imagination (24 items, .93).

Data Analyses

Mediator Analyses. We used indirect effects macro to estimate total, direct, and single-step indirect effects with bias-corrected 95% confidence intervals for the

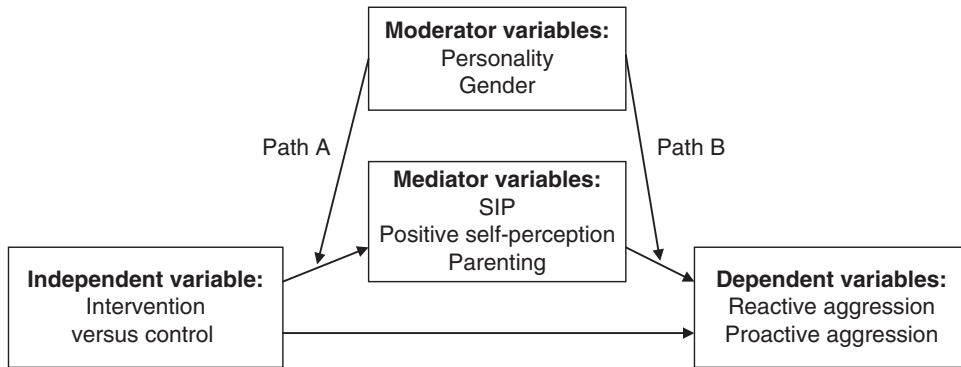


Figure 2. Hypothesized Moderated Mediation.

indirect effects (Preacher & Hayes, 2008). This procedure is recommended over the causal steps approach because there are no assumptions of direct intervention effects (e.g., MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Preacher & Hayes, 2008). Through the SPSS Macro (A. Hayes, The Ohio State University; <http://afhayes.com/spss-sas-and-mplus-macros-and-code.html>), total, direct, and single-step indirect effects of the intervention on reactive and proactive aggression through the proposed mediators (hostile intent, response generation, approval of aggression, enactment of aggression, maternal involvement, and overreactivity) are tested. For the indirect (mediation) effects, 95% bias-corrected confidence intervals are calculated (for details, see Preacher & Hayes, 2008). When zero is not in the confidence interval, it can be concluded that there is significant mediation (Preacher & Hayes, 2008).

Moderated Mediation Analyses. Moderated mediation is tested using a macro developed by Preacher, Rucker, and Hayes (2007), which allows us to determine the conditional indirect effect of the intervention on outcome variables (reactive and proactive aggression) through the proposed mediators (positive self-perception, Social Information Processing (SIP), or parenting). If mediating effects are moderated, this would be expressed by significant interactions between independent variable and moderator (gender and personality) on path A (see Figure 2), and between mediator and moderator on path B, which then would affect the indirect effect process. Significant moderated mediation is tested with tests of the indirect effects. For personality as moderator, we used the Johnson–Neyman technique (Preacher & Hayes, 2008). This produces ‘regions of significance for the conditional indirect effect at values(s) of the moderator(s)’ (Preacher et al., 2007). The macro allows us to test single mediator, moderator, and outcome variables at the same time (see Figure 2).

Results

Descriptives

Table 1 shows correlations between all variables at pretest. There are moderate relations between reactive and proactive aggression for both child ($r = .45, p < .01$) and teachers ($r = .45, p < .01$). Significant but low correlations between child and teacher reports of reactive ($r = .17, p < .01$) and proactive aggression ($r = .16, p < .05$)

Table 1. Intercorrelations among Assessed Variables at Pretest

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Reactive aggression child	—									
2. Proactive aggression child	.45**	—								
3. Reactive aggression teacher	.17**	.05	—							
4. Proactive aggression teacher	.18**	.16*	.45**	—						
5. Positive self-perception	-.31**	-.31**	-.07	-.24**	—					
6. Hostile intent	.19**	.14*	-.06	.06	-.08	—				
7. Response generation	.44**	.49**	.12	.08	-.22**	.22**	—			
8. Approval of aggression	.34**	.45**	.09	.08	-.24**	.20**	.50**	—		
9. Enactment of aggression	.42**	.49**	.07	.10	-.24**	.19**	.55**	.78**	—	
10. Maternal involvement	-.12	.02	-.06	-.04	.11	-.07	-.09	.03	.05	—
11. Maternal overreactivity	.12	-.01	.04	.06	-.13	.08	.07	.04	.00	-.17*

Note: * $p < .05$, ** $p < .01$.

Table 2. Means, Standard Deviations and Effect Sizes for Outcome Variables

Outcomes	Intervention		Control		Effect size
	Pre <i>M (SD)</i>	Post <i>M (SD)</i>	Pre <i>M (SD)</i>	Post <i>M (SD)</i>	
Reactive aggression					
Child	3.03 (.88)	2.80 (.81)	3.03 (.81)	3.00 (.87)	.21
Teacher	3.84 (.87)	3.40 (.89)	3.74 (.95)	3.57 (.94)	.28
Proactive aggression					
Child	1.48 (.70)	1.35 (.54)	1.61 (.80)	1.62 (.84)	.22
Teacher	2.46 (.89)	2.09 (.98)	2.17 (.89)	2.08 (.92)	.30

SD, standard deviation.

are found. There are stronger correlations between child cognitions and aggression according to child; only one significant correlation between child cognition and teacher-reported aggression is found (i.e., positive self-perception is significantly negatively related to teacher report of proactive aggression, $r = -.24$, $p < .01$).

Table 2 shows means, *SD*, and effect sizes for outcome behavior. Analyses of covariance with pretest scores as covariate and condition status (0 = *control group* and 1 = *intervention group*) as a fixed factor revealed that children who received the Stay Cool Kids intervention reported less reactive [$F(2,263) = 4.06$, $p = .02$] and proactive aggression [$F(2,263) = 8.02$, $p = .02$], compared with children in the control condition. For teacher-reported reactive aggression, intervention effects were significant [$F(2,263) = 3.81$, $p = .05$]; however, no significant intervention effect was found for teacher-reported proactive aggression (see also Stoltz, van Londen, et al., 2012).

Mediation

When child-reported outcome measures are used, social information processing steps did not significantly mediate intervention effects. However, the indirect effect of the intervention on child-reported reactive aggression through mediator 'child positive self-perception' was significant (.07, 95% confidence interval [.02 to .17]). The sign of the indirect effect is consistent with the interpretation that the intervention increases positive self-perception, which in turn influences aggressive behavior. The indirect effect of the intervention on child-reported proactive aggression through child positive self-perception was significant as well (.04, 95% confidence interval [.00 to .11]). The indirect effects of the intervention on child-reported reactive aggression and proactive aggression through the mediator 'change in maternal involvement' were significant (indirect effect on reactive aggression: .06, 95% confidence interval [.00 to .22]; indirect effect on proactive aggression: .03, 95% confidence interval [.01 to .15]). Overreactivity did not mediate intervention effects.

For teacher-reported reactive and proactive aggression, no significant mediation effects were found.

Moderated Mediation

We found only limited evidence for working mechanisms of the intervention. The intervention resulted in a change in positive self-perception, which in turn was related to less aggression. Moreover, after the intervention, there was an increase in maternal involvement, which was related to less aggression. No significant mediation was found for the social information processing variables and for maternal overreactivity. Because it is possible to find mediation effects for specific subgroups, in absence of overall mediation effects (Kraemer, Wilson, Fairburn, & Agras, 2002), we tested moderated mediation for all potential mediators. Therefore, in the next step, we examined whether indirect effects for all potential mediators were moderated by child gender and personality.

Gender as Moderator of Mediation. A significant interaction effect between gender and condition (control vs. intervention) was found on *child-reported* proactive aggression ($t = -2.52, p = .03$). It can be concluded that the intervention resulted in a larger reduction of proactive aggression for boys ($d = .55$) compared with girls ($d = .23$). No significant interaction effects of gender as moderator with positive self-perception or maternal involvement as mediators were found on *teacher- and child-reported* reactive and proactive aggression. This indicates that although boys benefited more of the intervention on proactive aggression, mediation mechanisms in reducing reactive and proactive aggression are the same for boys and girls. We found some significant interactions with the (nonsignificant for the total sample) mediators SIP and overreactivity, which indicates that some of the (nonsignificant) indirect effects through these mediators differ between boys and girls. However, inspecting confidence intervals for the indirect effects separately for boys and girls resulted in no significant mediation.

Personality as Moderator of Mediation

Conscientiousness. Testing the moderated mediation model with personality aspect 'conscientiousness' as moderator, no significant interaction effects were found for mediators self-perception, hostile intent, approval of aggression, and enactment of aggression on teacher- and child-reported reactive and proactive aggression. A significant interaction effect was found for the proposed mediator 'response generation' and the moderator 'conscientiousness' on child-reported reactive aggression, which indicates that for children with different levels of conscientiousness, indirect effects of the intervention through mediator 'response generation' differ. However, inspecting confidence intervals for indirect effects for specific values of the moderator 'conscientiousness' indicated no significant mediations for specific subgroups. Although conscientious children seemed to benefit more from the intervention (i.e., moderated intervention effects) in a previous study (Stoltz, Prinzie, et al., 2012), mediation effects are the same for all children.

Extraversion. No significant interaction effects of the moderator extraversion with mediators' positive self-perception, approval of aggression, and enactment of aggression were found on teacher- and child-reported reactive and proactive aggression. Although less extraverted children seemed to benefit more from the intervention in a previous study (Stoltz, Prinzie, et al., 2012), the effect of the intervention, through

these mediators, on reactive and proactive aggression does not depend on level of extraversion in children.

Two significant interaction effects were found on child-reported reactive aggression: extraversion \times hostile intent, and extraversion \times response generation, which indicates that for specific values of extraversion, indirect intervention effects through hostile intent and response generation differ. For these proposed mediators, no mediation was found for the total sample, and inspecting confidence intervals for specific values of extraversion indicated no significant mediation for subgroups of children either. However, a significant interaction effect on child-reported reactive aggression was found for the extraversion \times involvement interaction ($t = 2.08, p = .04$). This indicates that the level of extraversion moderates the relation between involvement and reactive aggression. Bootstrapped confidence intervals indicate that the indirect effect of the intervention, through an increase in involvement, resulted in less reactive aggression, only for children with less extreme scores (range 2.66–3.44) on extraversion (95% confidence interval range: $-.40$ to $-.01$). For children who scored either low or high on extraversion, indirect effects through an increase in involvement were nonsignificant.

Discussion

The present study extends prior studies on effectiveness of child interventions for reducing aggressive behavior by testing mediators of intervention effects under real-world conditions and by examining whether mediation is moderated by child characteristics. To our knowledge, this study is one of the first to test whether mediating mechanisms may vary by moderators (Gardner, Hutchings, Bywater, & Whitaker, 2010; Tein et al., 2004) and therefore can answer the question ‘what works for whom, how, and in what circumstances?’ (Yirmiya, 2010). From a previous study, we could already conclude that the individual school-based Stay Cool Kids intervention, for children indicated with externalizing behavior, was effective in reducing aggressive behavior (*‘What works’* question; Stoltz, van Londen, et al., 2012). The results of mediation analyses in the current study provide evidence for child’s positive self-perception and maternal involvement as working mechanisms of the Stay Cool Kids intervention (*How does the intervention work?*). Child personality moderated the mediating effect of involvement whereas no moderated mediation was found for gender. In other words, the intervention works through the same mechanisms for boys and girls but through different mechanisms depending on personality characteristics. (*For whom and under what circumstances does the intervention work?*)

Mediator analyses show that an increase in positive self-perception appears to be a key factor mediating change in reactive and proactive aggression. One step of the SIP model, approval of aggression, changed after participation in the intervention (Stoltz, van Londen, et al., 2012), but approval of aggression was not a significant mediator of intervention effects. In contrast, increasing maternal involvement seemed to be an active ingredient of the intervention for reducing aggressive behavior. These findings extends other intervention studies that examined mediators of effects of social-cognitive interventions under research conditions (e.g., Lochman & Wells, 2002), by focusing on a routine-practice intervention. Moreover, results may contribute to developmental theories of children’s aggressive behavior; changes in child and parent processes can influence aggressive behavior in a specific high-risk group displaying symptoms of externalizing disorders. The mediating effect of child’s positive self-perception in the current study shows that improving positive self-perception seems to

be related to less aggression, which is in agreement with previous studies on the relation between self-esteem and externalizing behavior (Donnellan et al., 2005).

Little evidence was found for the role of SIP as working mechanism in the current intervention, which can be explained in several ways. Although trainers reported high treatment fidelity, it is possible that they focused mainly on changing self-perception in the trainings rather than focusing on changing SIP. Future studies, in which videotapes will be analyzed, should unravel the exact content of the training sessions. Secondly, the link between mediator and outcome may suffer from measurement problems. In this study, SIP is measured using self-reports in which children have to represent and verbally describe what they would do in hypothetical situations. It has recently been suggested that SIP should be measured directly rather than inferred from self-report measures. For example, it has been found that through eye-tracking, using direct assessment in real time, encoding cues and hostile intent attribution can be better assessed (Horsley, Orobio de Castro, & van der Schoot, 2010).

An interesting finding was that participating in a child training resulted in an increase in maternal involvement. Increases in maternal involvement, in turn, resulted in decreases in reactive and proactive aggression. This finding is consistent with results of a meta-analysis on parenting interventions aimed to reduce antisocial behavior problems in youth (McCart, Priester, Davies, & Azen, 2006), in which it was found that changing parenting behavior may be particularly effective for changing behavior in younger children because of their dependency on their parents. The intervention did not result in significant changes in maternal overreactivity. Maternal involvement can be seen as a more 'general' aspect of parenting. Perhaps maternal involvement increased as a result of children being selected for the intervention or because of the contextual nature of the intervention. Although there was no specific teaching of skills for parents, it is possible that parental involvement increased as a result of involvement in the training. Overreactivity is a more specific parenting behavior, which possibly could be changed in a parent training, but not with the Stay Cool Kids child intervention.

It is important to note that mediation effects of self-perception and maternal involvement were only found for child-reported outcome behavior. Although participation in the intervention resulted in less teacher-reported aggression (Stoltz, van Londen, et al., 2012), no mediation of child-reported cognitions or mother-reported involvement was found for teacher-reported reactive and proactive aggression. This might indicate that teachers report on different behavior (school-based aggression) than children (aggression across context).

Although limited evidence was found for mediation of intervention effects (only through self-perception and maternal involvement on child-reported aggression), it is possible that for specific subgroups of children, working mechanisms of the intervention are present, in the absence of mediation for the total group. Whereas gender-moderated intervention effects on proactive aggression, mediators were not moderated by gender. This indicates that boys benefited more from the intervention, in terms of reductions in proactive aggression, which may raise the question whether the intervention should be adapted for girls. However, working mechanisms through which reductions in aggression were achieved are the same for boys and girls. In contrast to gender, personality, more particular level of extraversion, moderated the mediating effect of maternal involvement. For children with less extreme scores on extraversion, the intervention produced increases in maternal involvement, which in turn mediated the programs effects on aggressive behavior. In a previous study (Stoltz, Prinzie, et al.,

2012), we found that children with less extreme scores on extraversion (a mean level of extraversion) benefited more from the intervention, perhaps because they are able to express their feelings (in contrast to very low extraverted children) and are better able to adjust to situations and to control their impulses (in contrast to very high extraverted children) (Tackett, 2006). The risk for poorer treatment outcomes associated with extraverted traits may be partly due to the relationship between extraverted traits, elevated activity levels, and less inhibited behavior. For these children, it may be more difficult to implement newly learned behavior. Interventions that focus on managing behavior (e.g., token reinforcement) may decrease the probability of problem behavior for highly extraverted children (DuPaul & Weyandt, 2006). Perhaps it is easier for mothers to be involved with children with less extreme extraverted behavior (i.e., children with a mean level of extraversion). Lower extraverted children may not enjoy social interactions, which can make it more difficult for parents to be involved and have positive experiences with their children, whereas highly extraverted children can be too dominant in social interactions with their parents (Tobin, Graziano, Vanman, & Tassinari, 2000), which may explain why involvement does not result in lower levels of aggression for these children.

Implications for Clinical Practice

The identification of mediators of effectiveness in a real-world setting trial has important implications for clinical practice. Firstly, for mental health care providers, it is important to know which ingredients are the core elements of an intervention, which result in a reduction in aggressive behavior. This can, in turn, lead to strengthen existing programs by focusing on effective components, and to changing or omitting components with smaller effects (Kaminski, Vallew, Filene, & Boyle, 2008). For the Stay Cool Kids intervention, improving positive self-perception and increasing maternal involvement are the core ingredients of the program. Secondly, trainers should be aware of different intervention effects for boys and girls and for children with different personality traits. For boys and girls, there are differences in intervention effectiveness, but working mechanisms are the same. However, it is important to know that different mechanisms might be operating for children with specific personality traits. Changing maternal involvement, through a preventive intervention for reducing aggression, results in larger effects for less extreme extraverted children. This knowledge can perhaps lead to personalized mental health care, in which programs are adapted to children's specific needs so that the effects of interventions can be enhanced (Chorpita, Daleiden, & Weisz, 2005).

Strengths and Limitations of the Study

Several limitations of the study should be mentioned. Firstly, when interpreting the results, it should be taken into account that Cronbach's alpha of reactive aggression reported by children at pretest is low. Secondly, two of the mediator variables (SIP and self-perception) and the dependent variable (aggressive behavior) are based on child reports. The findings of this study should be replicated by other measures such as observations of child behavior or reports of other informants (e.g., teachers and parents). On the other hand, we were able to assess maternal involvement and child personality with other informants (mothers and teachers). Shared method bias, which may lead to inflated correlations, is a common problem in studies testing mediation

(Weersing & Weisz, 2002). Thirdly, as in many other intervention studies, mediators and outcomes were measured at two time points: pre- and post-intervention (e.g., Gardner et al., 2010). Using more time points would be better for testing mediation because causal mechanisms can be demonstrated. Because of the relatively smaller sample size, we were not able to test more complex mediation models, which could give more information about how processes work together (Zhou, Sandler, Millsap, Wolchik, & Dawson-McClure, 2008). Also, several other child (e.g., prosocial behavior and peer relations) and parenting processes (e.g., parent–child relationship, monitoring) may contribute to changes in behavioral outcomes and should be examined in future studies. Moreover, with the research design in this study, twice as many intervention students as control students participated. Including more intervention students than control students does not inflate the effect sizes in this study (Dumville, Hahn, Miles, & Torgerson, 2006; Pocock, 1995). The results of the current study might not generalize to other age groups because children in elementary schools are more dependent on their parents and may not have developed yet the more abstract cognitive skills emphasized in the intervention (McCart et al., 2006). Perhaps, as children become older, the role played by social-cognitive variables becomes stronger, and the role played by mothers becomes weaker. Moreover, because of under-representation of girls in the intervention (70% boys and 30% girls), more positive effects of the intervention were found for boys. Finally, the moderated mediation analyses should be viewed as exploratory, and the findings should be interpreted with caution. Models that simultaneously examine mediation and moderation may suffer from power to detect effects because of concurrently testing indirect effects and interactions (Fairchild & MacKinnon, 2010). However, because of limited intervention studies testing mediation, and even fewer testing moderated mediation, exploratory studies are worthwhile. Despite these limitations, the present study indicated that changing self-perception in children and increasing maternal involvement through a preventive intervention for children at risk for externalizing behavior problems improved outcomes.

Again, it is important to realize that these mediating effects were found under real-world conditions. As has been stated in other studies (e.g., Gardner et al., 2010; Weisz, Sandler, Durlak, & Anton, 2005), this gives us information whether ‘theoretically important ingredients of the intervention are operating to effect change in the real world in the same ways as in more tightly controlled efficacy studies’ (Gardner et al., 2010).

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