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British Journal of Educational Psychology (2020), 90, 158–175

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Educating parents to improve parent–child interactions: Fostering the development of attentional control and executive functioning

Andrea M. Spruijt[1,2,*], Marielle C. Dekker[1], Tim B. Ziermans[1,3] and Hanna Swaab[1,2]

[1]Department of Clinical Child and Adolescent Studies, Faculty of Social and Behavioral Sciences, Leiden University, Leiden, The Netherlands
[2]Leiden Institute for Brain and Cognition, Leiden University, Leiden, The Netherlands
[3]Department of Psychology, University of Amsterdam, The Netherlands

Background. Parent–child interaction is essential in the development of attentional control (AC) and executive functioning (EF). Educating parents in AC and EF development may help them to respond more adaptively to their child's developmental needs.

Aim. This study aimed to investigate whether parents can be educated to improve interactions with their child through a compact psycho-educational programme that focuses on fostering the development of AC and EF.

Sample. Parents and their children in a low-risk sample of four- to eight-year-olds were randomly assigned to either the educational programme condition (N = 34) or the control condition (N = 36).

Methods. Parental supportive presence and intrusiveness were observed during home visits, and children's performance-based AC and EF were assessed before and after the four-session programme.

Result. Parents in the educational programme improved significantly in support (η_p^2 = .19) and intrusiveness (η_p^2 = .09) compared to controls. There was no short-term programme mediation effect on child AC and EF through parental support and intrusiveness. This study showed, however, that parents who improved after the educational programme had children who improved on AC and EF.

Conclusion. Parent–child interaction can be enhanced in a low-risk sample of four- to eight-year-olds using a compact educational group programme within the school community. Future studies should aim at examining variations in programme responsiveness and assessing associations between parent–child interaction and AC and EF over time.

The manner in which parents interact with their children influences their development and their school success (e.g., Englund, Luckner, Whaley, & Egeland, 2004; Trivette,

**Correspondence should be addressed to Andrea Spruijt, Department of Clinical Child and Adolescent Studies, Faculty of Social and Behavioral Sciences, Leiden University, Postbus 9555, 2300 RB Leiden, The Netherlands (email: a.m.spruijt.2@fsw.leidenuniv.nl).*

DOI:10.1111/bjep.12312

Dunst, & Hamby, 2010). Parenting educational programmes initially focused mainly on high-risk families, but more recently, programmes also aim to optimize conditions for child development through the involvement of parents regardless of risk status (Ailincai & Weil-Barais, 2013). The educational challenge of these kinds of programmes is to make parents aware of their own behaviour and help them realize their influence on the behaviour of their children, and to find ways to incorporate altered parenting practices into daily routines. The aim of the current study is to investigate whether parents can be educated to improve the interactions with their child through a compact psycho-educational programme that focuses on fostering the development of executive functions (EF) and attentional control (AC).

Fostering the development of EF and AC in young children has received increasing attention in recent years (Bierman & Torres, 2016). EF are adaptive neurocognitive processes fundamental to problem-solving that enable us to plan, guide, and control goal-oriented behaviour (Best, Miller, & Jones, 2009; Garon, Bryson, & Smith, 2008). There is general agreement that the three core EF components inhibition, working memory, and cognitive flexibility are interrelated, but can be distinguished reliably (e.g., Miyake *et al.*, 2000). These core EF share a common underlying mechanism, often referred to as effortful attentional control. AC is intertwined with EF as an ongoing process essential for EF development (Garon *et al.*, 2008). AC entails both the ability to actively focus on one thing without being distracted, known as focused attention, and the ability to maintain attention over prolonged periods of time, or sustained attention (Cohen, 2014). As both AC and EF have repeatedly been linked to the quality of development and the functioning in many important aspects of life, such as school performance, health, and job success (for a review, see Diamond, 2013), policymakers and practitioners recognize the relevance of preventive interventions targeting AC and EF development.

During the transition from dependence to greater autonomy, young children's AC and EF development is influenced by the relationship with their parents and the conditions in their caregiving environment (Bernier, Carlson, Deschenes, & Matte-Gagne, 2012; Diamond, 2013). Parent–child interaction is essential in the development of AC and EF, as adequate parenting provides support and external regulation in order for children to practise and internalize self-regulatory skills (Fox & Calkins, 2003; Giesbrecht, Muller, & Miller, 2010; Kopp, 1982; Sigel, 2002). As children grow up and increasingly seek out greater autonomy, many parent–child interactions can be marked as either supportive or controlling (Fox & Calkins, 2003). Supportive parenting requires parental understanding of these changing developmental needs during the preschool years (Landry, Smith, Swank, & Guttentag, 2008). However, achieving this understanding and supportively responding to their child's signals may be a difficult process for some parents. For instance, in one study only 25% of mothers from a low socio-economic background showed relatively stable high levels of sensitive responsiveness to their child's signals and another 25% even decreased dramatically between infancy and the preschool period (Landry, Smith, Swank, Assel, & Vellet, 2001).

Adequate parenting strategies, characterized by parents' ability to perceive and respond to their children's signals including attempts to support their child's need for independence, may foster the development of self-regulation. Indeed, parental support and intrusiveness have repeatedly been linked to the development of AC and EF in young children (e.g., Bernier, Carlson, & Whipple, 2010; Clark & Woodward, 2015; Cuevas *et al.*, 2014; Fay-Stammbach, Hawes, & Meredith, 2014; Gaertner, Spinrad, & Eisenberg, 2008; Kraybill & Bell, 2013; Mathis & Bierman, 2015; Spruijt, Dekker, Ziermans, & Swaab, 2018; Sulik, Blair, Mills-Koonce, Berry, & Greenberg, 2015). Parental support refers to

reassuring and supportive caregiving, while intrusiveness refers to lack of autonomy support or negative and controlling parenting (Dotterer, Iruka, & Pungello, 2012). While parent interventions aimed to improve school readiness (e.g., social cooperation, vocabulary) often include promoting supportive and non-intrusive parenting (for a review, see Welsh, Bierman, & Mathis, 2014), the effects of this type of intervention on child AC and EF development have not yet been examined.

Based on a growing body of neurodevelopmental research suggesting that self-regulation skills develop rapidly between ages four and eight (Best & Miller, 2010), a wide variety of preventive child interventions promoting AC and EF skills in young children have emerged over the last decade that show somewhat encouraging results. However, transfer to academic learning is often absent (e.g., Bergman Nutley *et al.*, 2011; Dowsett & Livesey, 2000; Thorell, Lindqvist, Bergman Nutley, Bohlin, & Klingberg, 2009). Programmes aimed at improving classroom quality and teacher–child relationships have shown more promising results, including positive effects on academic learning and AC and EF skills (e.g., Dias & Seabra, 2017; Raver *et al.*, 2011). For instance, in a study by Raver *et al.* (2008), teachers in the intervention condition scored higher on sensitivity and showed higher levels of positive classroom climate than controls, suggesting that improving teacher–child interactions can promote self-regulation skills and academic performance in young children. Interestingly, research in clinical populations has shown promising results of group-based parenting programmes. For instance, programmes such as Triple P and Parent Management Training have shown to be successful in improving parenting practices and reducing problem behaviours (Gross *et al.*, 2019; Sanders, Kirby, Tellegen, & Day, 2014), and group-based parent training using everyday practice contexts has demonstrated parenting-mediated treatment effects on effortful control and self-regulation in preschoolers with behavioural problems (Elizur, Somech, & Vinokur, 2017; Somech & Elizur, 2012). These findings are in line with the notion that high-quality caregiving promotes the development of AC and EF skills in young children (Bernier *et al.*, 2012). However, we do not yet know whether these effects are also generalizable to low-risk samples. As such, it is surprising that hardly any parenting programmes aimed at improving AC and EF development in low-risk samples have been explored.

Whether and how much parents can facilitate the development of self-regulation in their children warrants further study (Bierman & Torres, 2016; Diamond, 2013). Regardless of the type of intervention, repetition appears to be essential for the best results (for a review, see Diamond, 2013). For instance, school curricula successful in promoting self-regulatory skills involved repeated practice throughout the day and not just during one module (e.g., Diamond, Barnett, Thomas, & Munro, 2007; Raver *et al.*, 2008; Riggs, Greenberg, Kusché, & Pentz, 2006). This suggests that educating parents to implement self-regulatory skills practice during daily routines outside the school setting could be a valuable asset in promoting the development of AC and EF on a more regular basis. Interventions have shown the best results when self-regulatory skills were continually challenged with increasing demands, adaptive to the child's age and ability (e.g., Bergman Nutley *et al.*, 2011; Holmes, Gathercole, & Dunning, 2009). Parents may become more involved in their children's learning when they are educated about how their child reasons and learns (Gleason & Schauble, 1999). In this sense, parents educated in AC and EF development may be better equipped to recognize their child's level of competence and facilitate AC and EF development by adaptively challenging their child's self-regulatory skills. With this increased parental understanding of their child's developmental needs and by practising ways to promote children's learning during

parent–child interaction, parents may thus be better able to perceive and supportively respond to their child's signals.

The Curious Minds parent educational programme focuses on educating parents on how to support and scaffold the development of cognitive, social–emotional, and self-regulatory skills necessary for adaptive behaviour and learning while interacting with their child. The aim of the programme is to educate parents through group sessions and home assignments how they can stimulate AC and EF development as well as explorative behaviour and reasoning abilities through interaction that is sensitive to their child's developmental needs. We hypothesized that (1) parents in the educational programme condition (EPC) would show greater improvements in parental support and intrusiveness than controls; (2) parental support and intrusiveness would mediate the association between the EPC and the children's AC and EF performance after finishing the programme; and (3) parents within the EPC whose interaction with their child improved most had children who also improved most on AC and EF.

Method

Participants

The current study is embedded within the Curious Minds programme: a longitudinal programme investigating the development of executive and social functioning in primary school-aged children in the Netherlands and evaluating the effects of a parent and a teacher educational programme (approved by the Ethical Board of the Department of Education and Child studies at Leiden University (ECPW-2010016)).

Parents of 138 four- to eight-year-old children (M = 6.26 years, SD = 1.19, 55.1% male) from the lowest four grades of two Dutch primary schools (preschool to second grade in US school system) from towns that are part of the Rotterdam-The Hague Metropolitan Area were eligible for this particular study and signed an informed consent letter. The current study uses observational data of parents' interactive behaviour with their child collected during a home visit and child, computer-based neurocognitive measures of AC and EF. Children were randomly assigned to either the parent EPC or the control condition (CC). Participants were included in analyses when their parents had agreed to home visits, when parents attended at least two group sessions (EPC only), and when complete pre- and post-test data were available.

Parents of 99 out of the 138 eligible children agreed to both home visits (response = 71.7%). Participants whose parents agreed to home visits did not significantly differ from those who did not agree to home visits on the background variables: age, gender, school, grade, or prevalence of referral to mental health care in the past year; nor did their parents significantly differ on single-parenthood status or parental education (all $p > .05$). Participants in the EPC who missed all (N = 18) or three out of four (N = 5) sessions were excluded from analyses and also did not significantly differ from those who remained in the EPC on any of the background variables (all $p > .05$). The final sample size for analysis (N = 70) consisted of 34 children in the EPC and 36 in the CC. For detailed sample characteristics, see Table 1.

Procedure

Pretest baseline data were collected in the period between November 2013 and February 2014 (school 1) and between May and June 2014 (school 2). Post-test data were collected

Table 1. Participant characteristics and descriptive statistics variables of interest

Educational programme analysis	Total (n = 70)	EPC (n = 34)	CC (n = 36)	p
Age in months at T1 (*M* [*SD*])	76.25 (14.49)	76.56 (14.89)	75.97 (14.32)	.87
Sex (% male)	55.71	47.06	63.88	.16
Parental education[b]				.91
High (%)	44.77	43.75	45.71	
Medium (%)	47.76	50.00	45.71	
Low (%)	7.46	6.25	8.57	
Single parenthood (%)	4.48	6.25	2.86	.60
Referral to mental health care in the past year (%)	7.46	6.25	8.57	.72
Parental sensitivity T1[c]				
Supportive presence (*M* [*SD*])	3.94 (1.52)	3.88 (1.61)	4.00 (1.44)	.61
Intrusiveness (*M* [*SD*])	3.73 (1.44)	3.62 (1.41)	3.83 (1.47)	.73
Child factors T1				
Attentional control (*M* [*SD*])	.28 (2.22)	.37 (2.47)	.20 (1.98)	.76
Executive functioning (*M* [*SD*])	.31 (1.91)	.38 (1.80)	.25 (2.04)	.78

Principal component analysis[d]	Total (n = 225)
Age in months at T1 (*M* [*SD*])	73.53 (14.65)
Sex (% male)	54.22
Parental education[a]	
High (%)	49.04
Medium (%)	46.15
Low (%)	4.81
Single parenthood (%)	5.30
Referral to mental health care past year (%)	7.96

Note. CC, control condition; EPC, educational programme condition.
[a]Background information was missing for N = 17 children due to non-response on parent questionnaires.
[b]Background information was missing for N = 3 children due to non-response on parent questionnaires.;
[c]Original values before standardization.
[d]See Appendix.

in the period between June and July 2014 (school 1) and between January and February 2015 (school 2). Computer-based performance tasks were administered during an individual test session of approximately 60 min in a separate quiet room at the child's school. Tests were administered by two trained junior investigators or by one of the senior investigators. Children were rewarded for participation with a small token of appreciation after the test session.

Curious Minds educational programme

The content of the educational programme was inspired by the Vygotskian principles of the Tools of the Mind curriculum for preschool children (Bodrova & Leong, 2007; Diamond *et al.*, 2007), which focuses on supporting and scaffolding the development of cognitive, social–emotional, and self-regulatory skills necessary for adaptive behaviour and learning using a familiar adult in a real-life setting as a change agent. The programme was provided by a skilled clinical neuropsychologist specialized in child and adolescent neurodevelopment after all baseline assessments were completed, and consisted of four, monthly group sessions of approximately 2 hr each at the child's school. Practical

feasibility and the potentiality to cover all topics and home assignments as presented in Table 2 were the main rationale for the delivery of the programme in four group sessions. Furthermore, 2-hr meetings with groups have previously been used in successful parenting programmes aimed at clinical populations (Elizur *et al.*, 2017; Sanders *et al.*, 2014). The caregiver of each child who also participated in the home visits was asked to attend the group sessions.

During each session, the focus was on a specific (neuro)cognitive mechanism, for which parents received basic information about the brain–behaviour developmental course at specific ages, using everyday examples of parent–child interaction. Parents also received a workbook summarizing information about development, as well as matching home assignments following each session to enhance the learning experience of parents. Home assignments were based on some well-established EF measures that have been successful in improving specific EF components (for a meta-analysis, see Kassai, Futo, Demetrovics, & Takacs, 2019). Active rehearsal of parent–child interaction took place at home with their own child using the home assignments. These home assignments were discussed during the following session, allowing parents to learn from the educator's feedback and each other's day-to-day experiences. For a more detailed description per session, see Table 2.

Measures

Demographic characteristics

Parents filled out a complementary background information questionnaire, using the online survey software Qualtrics (http://www.qualtrics.com/). The highest completed level of education was used as an indicator of educational attainment according to the Dutch Standard Classification of Education (SOI) which is based on UNESCO's International Standard Classification of Education (ISCED; 'SOI 2003 (Issue 2006)/ '07)'): (1) primary education (SOI levels 1–3; at most vocational training); (2) secondary education (level 4 of SOI); and (3) higher education (levels 5–7 of SOI; bachelor's degree or higher). Single-parenthood status was defined by not having the child's other parent or a new caregiver living in the same household. Mental health care referral was assessed by asking parents whether their child had been referred, examined, or treated for emotional and behavioural problems in the past year.

Parental support and intrusiveness

The parent's interactive behaviour with the child was videotaped at pre- and post-test home visits during two joint activity tasks. These tasks consisted of a combining task and a sorting task of approximately 5–10 min each, both based on tasks designed by Utrecht University (Corvers, Feijs, Munk, & Uittenbogaard, 2012). The videotapes were coded afterwards for level of parental supportive presence and intrusiveness using the revised Erickson 7-point scale for Supportive Presence and Intrusiveness (Egeland, Erickson, Clemenhagen-Moon, Hiester, & Korfmacher, 1990). The subscales SP and Intrusiveness were coded independently for each joint activity task by one out of three coders who were blind to other data concerning the child or the parent. Intraclass correlations (ICCs) between coders directly after training were .92 for the SP scale ($N = 12$) and .81 for the Intrusiveness scale ($N = 12$). At the end of the coding process, ICCs were .91 for the SP scale ($N = 12$) and .92 for the Intrusiveness scale ($N = 12$), suggesting no significant rater

Table 2. Description of the discussed topics and home assignments per session of the Curious Minds educational programme

Session	Main theme	Home assignments
Session 1	How children learn and process new information, how this is regulated through AC and EF, and how parents can help their child explore new topics in more depth by being more supportive, less intrusive, and by asking questions	For example: • Do science experiments with soap bubbles • Think outside the box by imagining as many different uses for a paperclip as possible • Play sensory games, such as touching and tasting different types of food while blindfolded
Session 2	Teaching parents how to stimulate specific aspects of AC and EF while interacting with their child. Discussion of home assignments session 1	For example: • Tell two different stories to your child simultaneously, while your child focuses on one of the stories, and ask questions afterwards about its content (targeting *attention*) • Play the game *Yes and no are forbidden*: Trick your child into answering questions with 'yes' or 'no (targeting *inhibition*) • Play the *Going on a trip* game: Alternately add an item to the sentence 'I am going on a trip and I am going to pack. . .', after recalling all items that have been mentioned (targeting *working memory*) • Let your child come up with alternative plans when a playdate is suddenly cancelled, and observe whether your child is able to flexibly change plans (targeting *cognitive flexibility*)
Session 3	Teaching parents how to stimulate emotion regulation and social cognition while interacting with their child. Discussion of home assignments session 2	For example: • Practise and discuss a range of facial emotion expressions in front of the mirror • Observe and address your child's emotional reactions during daily interaction and describe the reactions • Discuss several short, illustrated stories (e.g., *How does Billy feel when he's not allowed to play with the other kids? How do you know?*) • In a naturally occurring situation, explain why it is important to place yourself in someone else's shoes (i.e., perspective taking), using questions
Session 4	Recap of sessions 1 through 3; parents were free to discuss what they had learned and ask additional questions. Discussion of home assignments session 3	There were no home assignments following session 4

drift. Consensus was sought after a discussion with all coders whenever interactions were difficult to score due to an ambiguous interaction (N = 14). A parent scoring high on Supportive Presence is reassuring when the child is experiencing difficulty with the task and gives emotional support to the child. A parent scoring high on Intrusiveness lacks respect for the child's autonomy and does not acknowledge the child's intentions or desires (for detailed task descriptions, see Spruijt et al., 2018).

Attentional control and executive functioning

AC and EF were measured with several neuropsychological tasks from the Amsterdam Neuropsychological Tasks (ANT, version 2.0), assessing focused and sustained attention, inhibition, working memory, and cognitive flexibility. The ANT is a well-validated computerized test battery (De Sonneville, 2005, 2014). The ANT has been used extensively in both clinical and non-clinical populations and contains widely used paradigms such as the Go/No-Go paradigm, that has shown good test and test–rest reliability (r = .84) in adults (Wostmann *et al.*, 2013), and comparable paradigms have also shown adequate test–retest stability in children (Kindlon, Mezzacappa, & Earls, 1995), as well as the Hearts and Flowers paradigm which has been validated for children as young as four years old (Davidson, Amso, Anderson, & Diamond, 2006; Diamond *et al.*, 2007). All computer tasks were preceded by instructions and practice trials (for detailed task descriptions, see Appendix, Table A1, and Spruijt et al., 2018).

Data analyses

Data were analysed using IBM SPSS version 23. Demographic characteristics for both schools and conditions were compared with chi-square tests, independent *t*-tests, and Fisher's exact tests. Principal component analysis was conducted on the pretest ANT data of the larger Curious Minds sample (N = 225) to form coherent and relatively independent subsets of variables to reduce the number of observed ANT variables to a smaller number of components (see Appendix). The educational programme effect on post-test parental support and intrusiveness was assessed using ANCOVA controlling for their corresponding pretest values. The educational programme effect on AC and EF components through mediation by supportive presence and intrusiveness was assessed using bootstrapping, a nonparametric resampling procedure (Hayes, 2009). Bootstrapping with 5,000 resamples was done to test for significant indirect effects using the SPSS macro developed by Preacher and Hayes (2009). Pretest values and age were controlled for in all analyses. *Post-hoc* regression analyses with sensitivity change scores within the EPC were conducted to assess whether especially those parents who improved after the programme on supportive presence and intrusiveness had children who improved on AC and EF. Change scores were calculated by subtracting pretest from post-test scores and reversing the intrusiveness change score. For all significant effects, partial η^2 or standardized β addressed effect size (.04 = small effect; .25 = moderate effect; and .64 = strong effect for partial η^2; and .20 = small effect; .50 = moderate effect; and .80 = strong effect for standardized β) (Ferguson, 2009). Alpha for significant effects was set at $p \leq .05$.

Results

Sample characteristics and descriptive statistics for the variables of interest are displayed in Table 1. Participants in the EPC did not significantly differ in age, gender, school, grade,

single-parenthood status, parental education, or prevalence of referral to mental health care in the past year from those in the CC. Nor did they differ on level of AC or EF at pretest (all $p > .05$).

Curious Minds educational programme effects

Parent–child interaction

At post-test, parents in the EPC scored significantly higher on support ($\eta_p^2 = .19$), showing a small-to-moderate effect size, and lower on intrusiveness ($\eta_p^2 = .09$), a small effect, than parents in the CC, while controlling for pretest parenting scores (see Table 3; Figure 1).

Mediating effect of parent–child interaction on AC and EF

Next, we investigated whether the educational programme produced a short-term effect on child AC and EF, mediated by support and intrusiveness. There were no direct effects of the educational programme on child AC or EF. Even though regression coefficients between EPC and both parental support and intrusiveness were significant, standardized indirect effects for AC and EF were non-significant (see Table 4). This indicates that

Table 3. Analysis of covariance (ANCOVA) results comparing educational programme and CC on parenting strategies at post-test, controlling for corresponding pretest score

	EPC *M* (*SD*)	CC *M* (*SD*)	*F* (*df*)	η_p^2	*p*
Parenting strategies					
Supportive presence	.26 (.94)	−.32 (.92)	15.87 (67)	.19	<.001
Intrusiveness	−.24 (.87)	.28 (.96)	6.42 (67)	.09	.01

Note. CC, control condition; EPC, educational programme condition; *M*, mean; *SD*, standard deviation; η_p^2, partial eta-squared.

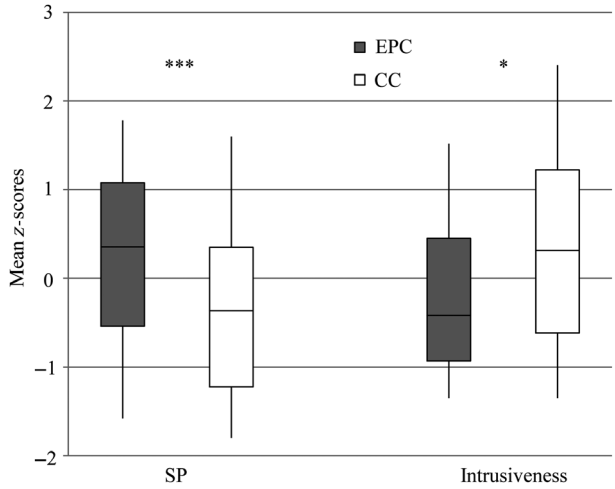

Figure 1. Educational programme effect at post-test on parental supportive presence and intrusiveness for the educational programme condition (EPC) and control condition (CC), controlled for pretest values. * p<.05; *** p<.001.

Table 4. Bootstrapping analysis results with parenting as a mediator in the relation between EPC and AC and EF

				AC			EF		
	Direct effect	95% CI			95% CI			95% CI	
Mediator	Programme – parenting	Low	Up	*b* (*SE*)	Low	Up	*b* (*SE*)	Low	Up
Total effect programme				.34 (.32)	−.31	1.00	.31 (.32)	−.33	.95
Covariate age				.09 (.01)***	.06	.12	.01 (.01)	−.01	.03
Covariate T1 AC/EF				.19 (.10)†	−.01	.40	.55 (.10)***	.35	.75
Supportive presence	.65 (.16)***	.31	.98						
Direct effect programme – AC/EF				.10 (.35)	−.62	.81	.20 (.35)	−.51	.91
Indirect effect (mediation)				.25 (.17)	<−.01	.68	.11 (.16)	−.19	.46
Intrusiveness	−.46 (.19)*	−.84	−.07						
Direct effect programme – AC/EF				.22 (.33)	−.45	.90	.26 (.33)	−.41	.92
Indirect effect (mediation)				.13 (.13)	−.04	.51	.06 (.10)	−.11	.31

Note. Results based on 5,000 bootstrapped samples. 95% CI = bias-corrected and accelerated confidence intervals, with $p < .05$ when range lower–upper CI does not include zero. Covariate T1 AC/EF refers to corresponding pretest component. *p<.05, **p<.01, ***p<.001, †p<.10

support and intrusiveness did not act as a significant mediator between EPC and AC and EF.

Differential effects within the educational programme

Within the EPC, regression analyses showed that a higher change score for supportive presence at post-test was significantly associated with better AC (b = .53, SE = .24, 95% CI [.08, 1.09], β = .21, p = .03) and better EF (b = .65, SE = .34, 95% CI [.18, 1.56], β = .30, p = .05) at post-test, controlled for pretest values of AC and EF and age. A higher change score for intrusiveness was marginally associated with better AC (b = −.45, SE = .24, 95% CI [−.92, .02], β = .20, p = .06), but not EF (b = −.10, SE = .28, 95% CI [−.68, .46], β = .05, p = .73), at post-test. No such associations were found in the CC.

Discussion

The aim of the current study was to investigate whether parents can be educated to improve interactions with their child through a compact psycho-educational programme with home assignments. Focusing on parenting strategies that have been shown to have positive impact on children's attentional control (AC) and executive functioning (EF), this study showed in a low-risk sample of four- to eight-year-olds that parents in the EPC scored significantly higher on supportive presence and lower on intrusiveness than controls. Though parenting strategies did not act as a mediator between educational condition and child AC and EF, children of those parents who improved after the educational programme showed enhanced AC and EF performance.

At post-test, parents in the Curious Minds educational condition were more supportive and less intrusive towards their child during joint activity problem-solving tasks than controls were. This is in line with the positive results regarding programmes aimed at improving teacher–child relationships in order to promote self-regulatory skills (e.g., Raver *et al.*, 2008). Our study results suggest that certain aspects of parental sensitivity can indeed be improved using a compact educational programme teaching parents about how their child reasons and learns, and how to implement self-regulatory skills practices during daily routines. Potential benefits of this educational group programme in comparison with, for instance, home visiting programmes targeting school readiness (for a review, see Welsh *et al.*, 2014) include its high cost-effectiveness and wide employability.

Adequate parenting strategies, characterized by attempts to support the child's need for independence, have already repeatedly been linked to child AC and EF (e.g., Bernier *et al.*, 2010; Clark & Woodward, 2015; Cuevas *et al.*, 2014; Fay-Stammbach *et al.*, 2014; Gaertner *et al.*, 2008; Kraybill & Bell, 2013; Mathis & Bierman, 2015; Spruijt *et al.*, 2018; Sulik *et al.*, 2015). This suggests that educating parents may be a valuable asset in promoting the development of AC and EF, as they can implement self-regulatory skills practice during natural daily routines at home (Bierman & Torres, 2016). However, in the current study it was found that the Curious Minds educational condition did not lead to an overall improved AC and EF at post-test through changes in parental support and intrusiveness.

Several aspects that may explain this lack of effect on child outcomes have to be considered. First of all, previous studies have shown that greater benefits in AC and EF skills can be achieved in children who have larger initial deficits (Diamond & Lee, 2011; Diamond & Ling, 2016; Flook *et al.*, 2010; Karbach & Kray, 2009; Tominey & McClelland, 2011). Self-regulatory skills are often delayed in children growing up in a low-income

household with parents with low educational backgrounds (Noble, McCandliss, & Farah, 2007). As the current sample consists of low-risk children with parents who were less likely to have low levels of education (Central Bureau for Statistics [CBS], 2013), this may help explain why no detectable effect on child AC and EF was yet discernible after about a half year.

Second, due to restrictions related to school logistics, post-test data had to be assembled directly after completion of the educational programme. Perhaps parents need more time implementing what they have learned before measurable improvements in AC and EF development can be observed. Programmes that have improved teacher–child relationships (e.g., Raver *et al.*, 2008) and which have shown to positively impact child self-regulatory skills (e.g., Raver *et al.*, 2011) included at least 2 months of implementation time after the final session before post-test data were collected. Therefore, effects on child AC and EF may become apparent with time. This is in line with the findings of Dias and Seabra (2017), who have shown that EF gains after a teacher programme were amplified at a 1-year follow-up compared to direct post-test measurements, suggesting that some effects may indeed be larger later than directly after completing the programme (Diamond & Ling, 2016). These conclusions imply a need for longitudinal studies with multiple post-test measurements to disentangle whether an educational programme can achieve generalized and sustained effects on AC and EF development.

Third, the educational programme consisted of four sessions, which may have been too few to result in discernible improvements in AC and EF development. Interestingly however, *post-hoc* analyses showed that especially those parents who participated in the programme and who showed increased supportive presence at post-test had children who also showed improved AC and EF skills at post-test. As this association was not found in the CC, this may indicate that parents who benefitted from the programme did not only improve in supportive presence and intrusiveness but also altered their scaffolding in interaction with their children to be more beneficial to their child's AC and EF development. Future research needs to focus on this and other aspects of parent–child interaction that might enhance AC and EF development, and needs to find factors that will help explain why some parents benefit from an educational programme, while others do not. Little is known about variations in educational programme responsiveness and possible moderators affecting programme success on stimulating child development. Future studies might include moderating variables that are, for instance, found in meta-analytical studies focusing on child externalizing behavioural problems. These studies showed that programme success was moderated by economic disadvantage, severity of initial problem behaviour, parental educational level, and parental psychopathology (Lundahl, Risser, & Lovejoy, 2006; Reyno & McGrath, 2006). Nonetheless, even small improvements in self-regulatory skills may result in large benefits regarding outcomes in later life (Moffitt *et al.*, 2011), suggesting even small effects may become more and more prominent with time.

Fourth, as the opportunity to practise self-regulatory skills in a natural setting with a familiar adult may be the most promising approach to achieve generalized gains (Bierman & Torres, 2016) and repetition of self-regulatory skills practice throughout the day is essential for success (Diamond, 2013), educational programme effects on child outcomes may become more feasible when the school environment is also targeted. As such, greater benefits in child AC and EF may be observed when using a more integral approach, targeting both the school and the home environment. Future studies should aim to disentangle the effects of approaches aimed at parents as the sole recipient and more integral approaches, targeting the home and school environment both separately and complementarily.

Several limitations need to be acknowledged. First, parents may have acted differently during home visits than usual due to the somewhat contrived joint activity tasks. However, it should be noted that observing parent–child interaction under these relatively more natural conditions in the home environment is not expected to distort the nature of interaction much (Gardner, 2000). Second, our coding system focused on parenting behaviours. Consequently, real-time bidirectional relations between parenting strategies and child behaviour were not investigated. Third, children from only two Dutch schools in the same provincial region were included in this study, which limits the generalizability of our findings. Fourth, not all parents who were assigned to the educational condition participated or completed all sessions, which may have biased our results due to selective dropout. However, parents who were excluded from analyses did not significantly differ from those who remained in the educational condition, suggesting no attrition bias. Fifth, during the Curious Minds programme, the home assignments were not checked or monitored. Unfortunately, we do not have detailed information on the amount and quality of practice for each parent. Nonetheless, home assignments were discussed freely every following session, possibly generating cohesiveness and social pressure to complete the assignments.

This study is among the first few to examine manners in which parents can be educated to facilitate the development of self-regulation in their children by using a compact educational programme. Strengths of this study include randomizing to condition within each school rather than assigning schools to different conditions, limiting classroom effects. Furthermore, observed parenting behaviours were coded objectively with high inter-rater reliability and well-validated age-appropriate neuropsychological tasks were used to assess child AC and EF. In sum, the current study showed that the Curious Minds educational programme had the expected impact on the quality of parent–child interactions by improving parental support and intrusiveness compared to controls. Though no short-term mediation effects were found on child AC and EF through parental support and intrusiveness, we are reluctant to draw firm conclusions on these results alone, and tentative results suggested that especially parents in the educational condition who improved on parental support had children with better AC and EF skills. Future studies should aim at examining variations in educational programme responsiveness and assessing these relations over time. In addition, combining parent and teacher programmes may have the greatest potential for enhancing development.

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Received 5 September 2018; revised version received 1 July 2019

Appendix : Principal component analysis

Preliminary tests indicated that the data were suitable for principal component analysis, with Kaiser–Meyer–Olkin measure = .81 and Bartlett's test of sphericity = 573.53, $p < .001$. Results of the scree test showed that a two-component solution fit the data best. Results of the oblimin rotation showed substantive loadings (i.e., >.30) on Component 1 (eigenvalue = 3.45) and Component 2 (eigenvalue = 1.07; see Table 1). We labelled the extracted components *Attentional control* (AC) and *Executive functioning* (EF). AC and EF pre- and post-test component scores were computed using the component loadings, including lower (<.30) loadings. Composite scores were reversed, with higher scores indicating better performance on AC and EF. The Pearson *r* correlation coefficient between the AC and EF component was .43. With a mean time of 6.23 months (*SD* = 1.00) in between measurements, stability between pretest and post-test in the control group ($N = 57$) for the AC component ($r = .70$) and the EF component ($r = .69$) was high.'

Table A1. Principal component analysis results[a] for attentional control and executive functioning variables of the Amsterdam Neuropsychological Tasks (ANT; $N = 225$)

	Component loading	
Measures	C_1	C_2
%variance explained	49.24	15.28
Focused attention (FAO2)	**.97**	−.17
Sustained attention (SAO2)	**.89**	.01
Interference control (GNG misses)	**.60**	**.31**
Working memory (STS)	−**.53**	−**.42**
Inhibitory control – no response (GNG false alarms)	−.05	**.65**
Inhibitory control – different response (ROO 2)	.02	**.82**
Cognitive flexibility (ROO 3)	−.03	**.71**

Note. FAO2, Focused Attention Objects – 2 keys; GNG, Go-No-Go; SAO2, Sustained Attention Objects – 2 keys; STS, Spatial Temporal Span; ROO, Response Organization Objects.
Two-component solution (pattern matrix), oblimin rotation. Component loadings ≥.30 are displayed in bold.