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The Role of Teacher Behavior Management in the Development of Disruptive Behaviors: An Intervention Study with the Good Behavior Game

Geertje Leflot · Pol A. C. van Lier · Patrick Onghena · Hilde Colpin

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Abstract The role of teacher behavior management for children's disruptive behavior development (hyperactive and oppositional behavior) was investigated using a universal classroom preventive intervention study. Five-hundred seventy children were followed from second to third grade of elementary school. Observations of teacher behavior management and children's on-task and off-task classroom behavior and peer reports of hyperactive and oppositional behavior were available. Results showed that the reduced use of negative remarks of intervention teachers predicted children's increase in on-task behavior and decrease in talking-out behavior. These improved children's classroom behaviors in turn mediated the impact of the intervention on the development of hyperactive and oppositional behavior over the studied period. These results were similar for girls and boys. The results underscore the role of teachers' classroom management strategies in improving children's classroom behavior, which, in turn is an important component in the reduction of disruptive behavior development.

G. Leflot (✉) · P. Onghena · H. Colpin
Faculty of Psychology and Educational Sciences,
University of Leuven (K.U.Leuven),
Tiensestraat 102 box 3717,
3000 Leuven, Belgium
e-mail: geertje.leflot@psy.kuleuven.be

P. Onghena
e-mail: patrick.onghena@ped.kuleuven.be

H. Colpin
e-mail: hilde.colpin@psy.kuleuven.be

P. A. C. van Lier
Department of Developmental Psychology,
VU University Amsterdam,
Amsterdam, The Netherlands
e-mail: pac.van.lier@psy.vu.nl

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Within elementary school, teachers have an important role in managing children's behavior, including the management of children's disruptive behaviors (Rydell and Henricsson 2004; Sutherland and Oswald 2005). It is therefore not surprising that research has been directed at the link between teacher behavior management and children's classroom behavior. Studies have shown that adequate behavior management techniques (e.g., providing clear expectations and routines, stating clear rules and consequences, and consistently using praise and other rewards) can reinforce children's appropriate classroom behavior and may reduce disruptive classroom behaviors (e.g., Ferguson and Houghton 1992; Sutherland et al. 2008; Sutherland et al. 2000; Van Acker et al. 1996), while other behavior management techniques such as reprimands, corrections, and commands may elicit more child disruptions (e.g., Nelson and Roberts 2000; Wehby et al. 1995). Despite the existing empirical evidence on the links between teacher behavior management and children's behavior in the classroom, little is known about the consequences of teacher behavior management for children's further disruptive behavior development and about *how* teacher behavior management may affect this further development. The purpose of the present study is to investigate the role of teacher behavior management in the development of disruptive behavior in early elementary school, using a design with a universal classroom preventive intervention.

In this study we focus on the development of hyperactive and oppositional behavior. Children with hyperactive and oppositional behavior have been shown to be at increased risk for other concurrent problems, such as

deficient problem-solving skills and impaired social functioning, and negative future outcomes, such as substance use, poor academic achievement, and antisocial behavior (for overviews see Bubier and Drabick 2008; Dishion et al. 1995). Moreover, the transition to elementary school is shown to be a critical period for the onset and further development of these behaviors (Bongers et al. 2003, 2004).

The Role of Teacher Behavior Management in the Development of Hyperactive and Oppositional Behavior

Teacher behavior management is theorized to influence children's behavior through reinforcement (see Patterson et al. 1992; Sutherland and Oswald 2005; Wehby et al. 2004). Teachers are often confronted with disruptive behaviors in the classroom environment. Most disruptive behaviors they have to deal with are relatively trivial, such as talking out of turn, non-attending, disobedience, not remaining at their desk, and being off-task (Arbuckle and Little 2004; Dishion et al. 1995; Wheldall and Beaman 1998). It is possible to avoid many of children's disruptive behaviors by relatively simple teacher management techniques, such as providing children with positive attention when they engage in appropriate behavior (Weyandt 2006). Indeed, several studies have found a positive effect of teacher behavior management practices on children's immediate observed behavior in the classroom (e.g., Ferguson and Houghton 1992; Sutherland et al. 2000, 2008). In addition other studies have shown that it is possible to train these techniques, which resulted in improved child behavior (e.g., Mayer 1999; Shernoff and Kratochwill 2007; Webster-Stratton et al. 2001). However, teachers rarely have planned preventive and educational approaches to discourage disruptive behavior and promote adaptive behavior in the classroom (Stage and Quiroz 1997). When confronted with disruptive behavior, they frequently react in an irritable and coercive manner (Patterson et al. 1992; Sutherland and Oswald 2005). These frequent (negative) reactions to problem behaviors of the child by the teachers, combined with a lack of positive responses to appropriate child behaviors, may increase the risk of (unintentionally) reinforcing the child's disruptive behavior (Sutherland and Oswald 2005; Van Acker et al. 1996). The child has then learned to act out to escape academic tasks or for the purpose of gaining more (negative) teacher attention (Wehby et al. 2004).

In sum, teachers seem to be part of a chain of events, in which their behavior management is linked to classroom behaviors of children. These behaviors, in turn, may be predictive for children's future behavioral development. Indeed, it has been argued that early disruptive classroom behaviors increase children's risk for the development of disruptive behavior problems (cf. Dishion et al. 1995; Patterson et al. 1992; Reid 1993). This makes targeting teacher behavior management an interesting focus for the prevention of the development of hyperactive and oppositional behavior. In the present study the effect of a universal classroom intervention, the Good Behavior Game (GBG; Barrish et al. 1969; Dolan et al. 1989; also see e.g., Kellam et al. 2008; Dutch translation and adjustment by van der Sar and Goudswaard 2001) on teachers' and children's classroom behavior was investigated, to study if such changes explained hypothesized intervention effects on children's development of hyperactive and oppositional behavior.

The GBG is a classroom preventive intervention providing elementary school teachers with tools to reduce children's disruptive behavior, while promoting their prosocial behavior. Randomized controlled intervention trials showed that the GBG was effective in reducing (the development of) children's disruptive behavior, hyperactive and oppositional behavior in particular (e.g., Ialongo et al. 1999, 2001; Kellam et al. 1994; van Lier et al. 2004, 2005) and associated problems over time, such as alcohol abuse and depression (Kellam et al. 2008; Vuijk et al. 2007). However, studies investigating *how* the GBG affects children's disruptive behavior development are scarce. Some researchers hypothesized that the GBG reduces children's aggressive, disruptive behavior and its distal correlates by improving teacher's disciplinary practices (e.g., Ialongo et al. 1999, 2001; Kellam et al. 1998). However, despite this hypothesis, the focus of the GBG, and the clear potential of teacher behavior management, no studies to date have investigated its mediating role in the effect of the GBG on children's disruptive behavior.

In this study it will be investigated whether the GBG positively effects teacher behavior management and children's classroom behavior, and reduces children's growth of hyperactive and oppositional behavior; and if so, whether the improvements in teacher behavior management, via their effect on children's classroom behavior, explain reductions in growth of hyperactive and oppositional behavior among children who received the GBG program, as compared to controls. This was studied in a sample of 570 children followed over grades 2 and 3 of elementary school. We focused on two frequently studied child classroom behaviors, on-task and disruptive behavior and two teacher behavior management techniques, praise for appropriate behavior and negative remarks toward disruptive behavior (cf. Ducharme and Harris 2005; Ferguson and Houghton 1992; Kofler et al. 2008; Sutherland et al. 2000; Van Acker et al. 1996). We hypothesized that children's on-task behaviors would increase and their disruptive behaviors would decrease in the GBG classes at the end of each intervention year (end of the second and third grade) as opposed to the control classes. Furthermore, we hypothe-

sized that at the end of the second and third grade the GBG teachers would more frequently use praise and use negative remarks to a lesser extent than the control teachers. We also expected that the GBG would reduce children's growth of hyperactive and oppositional behavior from the beginning of second to the end of third grade as compared to the control group. Finally, we hypothesized that the increased effectiveness of behavior management among GBG teachers would predict children's improved classroom behavior within school year, and that these changes would mediate the effect of the GBG on children's hyperactive and oppositional development.

When studying this, gender was taken into account. Research has consistently shown that on average boys score higher on hyperactive and oppositional behavior than girls (Moffitt et al. 2001; Rutter et al. 2003). It has also been reported that boys usually display more disruptive classroom behavior than girls (Arbuckle and Little 2004), and that boys receive more negative (Arbuckle and Little 2004; Mayer 1999), but also more positive teacher reactions than girls (Arbuckle and Little 2004). Moreover, teacher behavior may have a different effect on boys and girls. It has been found that the link between teacher-child negativity and disciplinary problems is stronger for boys than for girls (Hamre and Pianta 2001). Finally, sex appeared to be an important moderator for the GBG effect on disruptive behavior, with the GBG having the largest effect on boys (e.g., Kellam et al. 1994; Ialongo et al. 1999). Therefore, in this study we will test for sex differences in the links among the GBG, teacher behavior management, child classroom behavior, and disruptive behavior development.

Method

Population

Fifteen schools participated in the study. All schools were located in rural to moderately urban communities (populations ranged from about 9 000 to 90 000) in the Flemish speaking part of Belgium (General Direction Statistics and Economical Information 2004). Students were followed from the beginning of the second grade (September 2006) until the end of the third grade (June 2008). Each school had two second grade classes, making a total of 30 classes. All children in these classrooms were eligible for inclusion. Written parental permission was obtained for 570 children (97%). Half of the children (49.5%) were boys. At the beginning of the second grade (wave 1), children's mean age was 7 years and 5 months (SD=4.6 months). The majority of the children and their parents had the Belgian nationality (>95%). Most parents completed higher education (63% of mothers, 57% of fathers). The remaining parents finished high school (28% of mothers, 30% of fathers), or completed primary school (9% of the mothers and 13% of the fathers). Two mothers and one father had received no education.

Over second and third grade, the implementation period of the GBG, classroom composition stayed intact. Only the teacher changed from the second to the third grade, which is usual in the Flemish educational system. Forty-one children were lost during the course of the study because of grade retention, or because of moving away from school. These children had higher initial levels of peer-rated hyperactive behavior ($t(568)=-3.58$, $p<0.01$), and oppositional behavior ($t(568)=-4.85$, $p<0.01$). They did not differ in initial level of observed on-task ($t(568)=-0.74$, $p=0.46$), talking-out ($t(568)=0.59$, $p=0.55$), or out-of-seat behavior ($t(568)=-0.42$, $p=0.68$).

Design

An intervention design with randomized experimental and control group and repeated measures was set up in September 2006 (cf. Brown and Liao 1999). A randomized block design was employed. Within each school the two classes of the second grade (with teacher and students) were randomly assigned to the intervention or the control condition. In 2006–2007, the GBG was implemented in the second grade intervention classes, according to the Dutch version of the program (cf. van Lier et al. 2004). In the school year 2007–2008, the GBG was further implemented in the same intervention classes (now in the third grade).

Data collection took place in the intervention and control classes at four points in time: prior to the implementation at the beginning of the second grade (wave 1, pre-test, September/October 2006), at the end of the second grade (wave 2, May/June 2007), at the beginning of the third grade (wave 3, September/October 2007), and at the end of the third grade, after terminating the intervention (wave 4, post-test, May/June 2008). At all four measurement waves behavioral observations of teachers' behavior management and children's classroom behavior, and peer nominations of children's hyperactive and oppositional behavior were available. The observations were scheduled during non-GBG moments, making it possible to observe generalization effects. Children were interviewed by a research team member during the school hours concerning their classmates' hyperactive and oppositional behavior (and other issues not relevant for the present paper).

Preventive Intervention

The Dutch adaptation of the GBG (by van der Sar and Goudswaard, 2001) was implemented, as Dutch is the official language in Flanders (Belgium). It is also the

mother tongue of the large majority of the children in this study. The GBG is a classroom team-based behavior management strategy that provides the teacher with tools to reinforce prosocial and on-task behavior and reduce antisocial and disruptive behavior. On the basis of behavioral observations, children are placed in heterogenic teams of four to five members. The teacher encourages prosocial and on-task behavior by praising teams and individual children who follow predefined rules (e.g., compliments for appropriate behavior: "Wow, you are doing a great job sitting quietly!"). Moreover, each team receives a number of cards, and the teacher removes one of the team's cards when a team member violates one of the predefined rules. The teacher gives no further attention to the disruptive behavior. The teacher rewards the teams again when at the end of the session at least one card remains. Teams are also rewarded at the end of the week and month, by means of social rewards, and small material rewards (e.g., a sticker) and/or activity rewards (e.g., story telling, extra playtime). The classroom rules, material and activity rewards are chosen by the children and teacher beforehand.

The GBG was implemented during two consecutive grades (second and third grade of elementary school). In each of the grades, the GBG was implemented from mid-October to mid-May, leaving enough time for data collection in the beginning and at the end of the school year (September–June). The GBG has three implementation phases, an introduction, an expansion, and a generalization stage. In each of these phases, the GBG is played during three sessions per week. In the introduction phase (3 months), the playtime of the GBG is gradually increased from 10 min per session, up to 45 min per session. The goal is to let teacher and pupils become acquainted with the GBG. In the expansion phase (next 3 months), the teacher further expands the duration of the game up to half a day per session. Finally, during the generalization phase (last 2 months of the school year) the GBG is still played three times a week; however, attention is focused on promoting prosocial behavior outside GBG moments by encouraging the teacher to compliment positive behavior and pay less attention to negative behavior outside GBG moments.

At the start of each phase teachers receive a half a day of training in group by a (trained) school consultant. Moreover, teachers are supervised and supported by the same school consultant during 10 60-min classroom observations over the school year. Manuals are available for teachers and school consultants.

All but one teacher reached the generalization phase of the GBG program. Via standardized observations the school consultant rated the implementation quality on six categories, such as "Does the teacher consistently remove a card when a child violates a rule?" and "Does the teacher compliment individual children and teams?" Each category is given a score from 0 to 2, with higher scores indicating better implementation (range total score = 0–12). The mean score over the classrooms was 9.21 (SD=1.38). Although some variation in implementation fidelity was found, we judged it applicable to use an intent-to-treat approach in the further analyses.

To minimize the information drift between GBG and control classes, the research team repeatedly explained why control teachers could not be informed about the GBG and frequently encouraged GBG teachers to withhold all GBG information from control teachers. It was clear from conversation with control teachers, that although they were aware of the goals of the program, they did not have specific knowledge about the GBG instructions, nor did they implement the GBG or parts of the program.

Instruments

Children's hyperactive and oppositional behavior was rated by peers. Children were asked to nominate all children in the classroom who met the behavioral descriptions "Cannot sit still in the classroom" (hyperactive) and "Disobeys in school" (oppositional). The number of nominations per description were summed and divided by the number of children in the class minus one (a child could not nominate him/herself). The internal consistency (Kuder-Richardson Formula 20; KR-20) was 0.91 for hyperactive and 0.90 for oppositional behavior (see also Cillessen 2009; Terry 2000). Test-retest reliability of the control group over 1 year was 0.73 and 0.79 for hyperactive and oppositional behavior, respectively.

Children's classroom on-task and disruptive behaviors were observed by two trained observers using an instrument developed by van der Sar (2004). Each child was observed six times during the morning when children were in a mathematics and/or language lesson. At each of the observation sessions, the on-task and disruptive behavior of the child was observed during 20 s. Then the next child was observed until all children in the classroom were observed. Then, the next round of observations started (total of six rounds over the morning).

For on-task behavior (e.g., listening to the teacher or doing assignments, *not* looking around, yawning, making grand gestures, or fidgeting,...) the child received a score from 0 (not on-task during the whole interval of 20 s) to 3 (on the task during the whole interval of 20 s). Disruptive behaviors (talking-out and out-of-seat behavior) were tallied on the observation sheet, if they occurred during the 20 s interval. Each of the two behaviors could be marked up to 6 times (1 time per observation session). For both behaviors, a mean score was calculated, resulting in a score ranging from 0 to 1 (1 indicating that a child displayed a certain disruptive behavior at each time interval

and 0 indicating that the child had not displayed that certain disruptive behavior over the six observation intervals). Prior to the first wave of data collection, two observers rated children's classroom behavior simultaneously during live classroom situations. Percentage agreement was 71%, 94%, and 92% for on-task, talking-out, and out-of-seat behavior, respectively.

Teacher's behavior management was observed following a procedure delineated by van der Sar (1999). At three points in time—before and after the first three rounds of child observations, and after the second three rounds—the teacher was observed for 10 min. During intervals of 20 s, followed by 10 s registration time, all teacher's verbal praise for positive classroom behavior and negative remarks for disruptive behavior were tallied on the observation sheet. Mean scores over the three observation periods for verbal praise and negative remarks were calculated, with a higher score referring to more of the concerned behavior. Prior to data collection, two observers simultaneously rated the teacher's use of praise and negative remarks during live classroom situations. The percentage of agreement was 93%.

Male sex and *intervention status* were dummy coded (0 = female, 1 = male; 0 = control group, 1 = GBG, respectively).

Results

Descriptive Statistics

The means and standard deviations for teacher behavior management and child classroom behavior for boys and girls in the GBG and control condition are reported in Table 1 and for hyperactive and oppositional behavior in Table 2. The correlations between the study variables are in Table 3.

GBG, Teachers' Behavior Management and Children's Classroom Behavior

To test for possible intervention status differences a series of ANCOVAs were conducted. For wave 2 and 4, the respective prior values at the beginning of the school year were added as covariates to the ANCOVA's. No significant differences between GBG and control teachers were found at the beginning of each school year (wave 1 and wave 3). At the end of second grade (wave 2) GBG teachers used significantly less negative remarks and marginally significant more praise than control group teachers. At the end of the second intervention year (wave 4) third grade teachers used significantly more praise, but not significantly less negative remarks, compared to control teachers.

With regard to child behavior, at wave 1 there were no significant differences between GBG and control group children. At the end of second grade (wave 2) GBG children showed significantly more on-task and less talking-out behavior than the controls. At wave 3, after the summer vacation, GBG children's on-task and talking-out behavior was similar to those of control children. At the end of third grade (wave 4) GBG children again showed significantly more on-task and less talking-out behavior than the controls.

These results showed that for both our hypothesized mediating variables (teacher behavior management and children's classroom behavior) GBG effects were found *within* 1 year. The effects were not carried over across grades. Thus, the changes in children's classroom behavior were investigated within one intervention year. No GBG effects on children's out-of-seat behavior or on teachers' negative remarks in third grade were found, and these variables were excluded from further analyses.

GBG and the Development of Hyperactive and Oppositional Behavior

The impact of the GBG on the development of hyperactive and oppositional behavior was analyzed using latent growth models in Mplus (Muthén & Muthén 1998–2009). Separate models were specified for hyperactive and oppositional behavior. Because randomization was at the classroom level and data were nested within these classrooms, we adjusted all standard errors for classroom level variation by using a sandwich estimator (Williams 2000). For this and all following models, a MLR estimator was used, which produces robust standard errors, controlling for the clustering and also for possible non-normality of the data. Model fit was determined through the Root Mean Square Error of Approximation (RMSEA; value ≤ 0.08 indicating adequate to good fit) (Browne and Cudeck 1993), Comparative Fit Index (CFI; values ≥ 0.90), and the Tucker Lewis Index (TLI; values ≥ 0.90) (Bentler 1990).

We first investigated the model needed to describe the development of hyperactive and oppositional behavior. A model with an intercept only had a somewhat poor model fit for both hyperactive (CFI/TLI=0.88/0.91; RMSEA=0.11) and oppositional behavior (CFI/TLI=0.90/0.92; RMSEA=0.11). Adding a linear slope increased model fit for both hyperactive ($\Delta\chi^2(3)=17.95$, $p<0.01$) and oppositional behavior ($\Delta\chi^2(3)=11.67$, $p=0.01$) (Satorra, 2000). Adding a quadratic slope did not improve model fit of the hyperactive model ($\Delta\chi^2(4)=8.64$, $p=0.07$). For oppositional behavior, the quadratic slope did improve model fit ($\Delta\chi^2(4)=17.46$, $p<0.01$). However, the variance of this growth parameter was not significant, and was therefore not added to the model.

Then, the impact of the GBG on the development of hyperactive and oppositional behavior was investigated, by regressing the growth parameters on the intervention status

Table 1 Means and Standard Deviations of Teacher Behavior Management (N=30) and Children's Classroom Behavior (N=570) for GBG and Control Group and for Girls and Boys (Only for the Latter) at all Four Measurement Waves

Variable	Sex						Intervention status					
	Girls		Boys		F test	Effect size	Control		GBG		F test	Effect size
	M	SD	M	SD			M	SD	M	SD		
Teacher behavior management												
Negative remarks w1							4.71	3.46	6.69	4.91	1.63	0.47
Negative remarks w2							3.91	2.21	2.24	2.20	5.63*	−0.76
Negative Remarks w3							5.18	5.08	3.69	3.31	0.90	−0.35
Negative Remarks w4							5.16	8.91	1.91	1.93	0.94	−0.50
Praise w1							0.58	0.73	0.87	1.21	0.63	0.29
Praise w2							0.73	0.80	2.00	2.22	3.63°	0.75
Praise w3							0.67	0.78	0.93	1.60	0.34	0.21
Praise w4							0.18	0.43	1.07	1.43	5.10*	0.84
Child classroom behavior												
On-task w1	2.99	0.40	2.94	0.40	0.39	0.13	1.95	0.43	1.98	0.36	0.45	0.05
On-task w2	3.01	0.45	2.99	0.47	0.49	0.04	1.87	0.44	2.14	0.44	50.10**	0.61
On-task w3	3.02	0.37	3.00	0.36	0.38	0.05	1.98	0.39	2.04	0.33	3.76°	0.17
On-task w4	3.03	0.31	3.02	0.27	0.16	0.05	1.99	0.32	2.06	0.25	4.23*	0.22
Talking-out w1	0.14	0.16	0.16	0.18	1.86	−0.11	0.16	0.18	0.14	0.16	2.48	−0.12
Talking-out w2	0.12	0.18	0.13	0.19	0.58	−0.06	0.18	0.21	0.07	0.12	52.70**	−0.62
Talking-out w3	0.11	0.15	0.14	0.17	3.99*	−0.17	0.13	0.17	0.12	0.16	0.20	−0.04
Talking-out w4	0.12	0.17	0.13	0.18	0.08	−0.09	0.15	0.19	0.10	0.15	9.77**	−0.29
Out-of-seat w1	0.18	0.20	0.23	0.23	8.16**	−0.24	0.20	0.22	0.20	0.22	0.05	0.01
Out-of-seat w2	0.13	0.17	0.14	0.19	0.27	−0.09	0.15	0.17	0.12	0.18	2.58	−0.14
Out-of-seat w3	0.17	0.19	0.17	0.21	0.22	−0.04	0.17	0.20	0.17	0.20	0.43	−0.06
Out-of-seat w4	0.13	0.20	0.14	0.18	1.44	−0.06	0.13	0.18	0.14	0.20	0.91	0.04

° p<0.10. * p<0.05. **p<0.01

w measurement wave

Table 2 Means and Standard Deviations of Hyperactive and Oppositional Behavior for Girls and Boys in the Control and GBG condition (N=570)

	Control				GBG			
	Girls		Boys		Girls		Boys	
	M	SD	M	SD	M	SD	M	SD
Hyperactive behavior								
Wave 1	0.07	0.12	0.19	0.23	0.09	0.13	0.22	0.24
Wave 2	0.09	0.15	0.22	0.24	0.09	0.15	0.24	0.26
Wave 3	0.09	0.18	0.24	0.25	0.09	0.15	0.23	0.25
Wave 4	0.09	0.15	0.25	0.24	0.10	0.18	0.23	0.25
Oppositional behavior								
Wave 1	0.04	0.10	0.16	0.21	0.07	0.12	0.19	0.23
Wave 2	0.08	0.14	0.21	0.24	0.07	0.13	0.21	0.26
Wave 3	0.06	0.12	0.22	0.23	0.07	0.15	0.20	0.25
Wave 4	0.05	0.12	0.22	0.24	0.05	0.11	0.19	0.26

Table 3 Correlations Between Hyperactive and Oppositional Behavior and Observed Child and Teacher Behaviors in the Classroom Over the Four Measurement Waves

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1. HB w1	–																						
2. OB w1	0.79**	–																					
3. HB w2	0.76**	0.69**	–																				
4. OBw2	0.69**	0.77**	0.81**	–																			
5. HB w3	0.66**	0.63**	0.79**	0.71**	–																		
6. OB w3	0.62**	0.71**	0.73**	0.82**	0.78**	–																	
7. HB w4	0.58**	0.56**	0.74**	0.67**	0.79**	0.67**	–																
8. OB w4	0.60**	0.71**	0.72**	0.80**	0.74**	0.83**	0.74**	–															
9. remarks w1	0.04	0.06	0.02	−0.03	0.01	−0.03	0.04	−0.01	–														
10 praise w1	0.03	0.02	0.01	0.00	−0.03	−0.02	−0.04	−0.04	0.46**	–													
11 remarks w2	0.04	0.00	0.05	0.07	0.06	0.02	0.04	−0.02	0.15**	0.06	–												
12. prasie w2	0.09*	0.07	0.03	0.05	−0.01	0.02	−0.03	−0.01	0.30**	0.64**	−0.13**	–											
13. remarks w3	0.00	0.02	−0.04	0.00	−0.01	0.00	0.05	0.05	0.13**	−0.02	−0.12**	0.17**	–										
14. prasie w3	0.03	0.01	0.00	0.04	−0.02	0.03	−0.01	0.02	0.01	0.28**	0.10*	0.03	0.09*	–									
15. remarks w4	0.02	0.01	0.00	0.01	0.02	0.00	0.07	0.07	0.13**	−0.08°	0.04	−0.03	0.67**	0.09*	–								
16. praise w4	0.07	0.04	0.00	−0.01	0.00	−0.02	−0.02	−0.05	0.05	0.33**	−0.02	0.33**	0.00	0.00	−0.14**	–							
17. on-task w1	−0.20**	−0.18**	−0.20**	−0.17**	−0.17**	−0.15**	−0.14**	−0.18**	−0.14**	−0.06	−0.05	−0.12*	0.02	0.10*	−0.11*	0.08°	–						
18. talking w1	0.15**	0.15**	0.16**	0.17**	0.18**	0.16**	0.16**	0.15**	0.14**	0.08°	0.11**	0.13**	0.00	−0.07	0.02	−0.04	−0.38**	–					
19. on-task w2	−0.16**	−0.12**	−0.21**	−0.22**	−0.23**	−0.18**	−0.21**	−0.17**	0.06	0.01	−0.31**	0.05	−0.05	−0.22**	−0.04	0.13**	0.04	−0.07	–				
20. talking w2	0.13**	0.05	0.15**	0.15**	0.16**	0.09*	0.17**	0.12**	−0.06	−0.08°	0.28**	−0.08°	−0.01	0.03	0.10*	−0.17**	−0.16**	0.19**	−0.47**	–			
21. on-task w3	−0.10*	−0.08°	−0.12*	−0.11*	−0.15**	−0.15**	−0.19**	−0.15**	0.02	−0.03	−0.05	−0.03	−0.34**	−0.06	−0.25**	−0.06	0.02	−0.06	0.13**	0.02	–		
22. talking w3	0.07	0.07	0.10*	0.10*	0.12**	0.13**	0.13**	0.10*	0.11*	0.04	0.06	0.05	0.18**	−0.05	0.15**	−0.01	−0.02	0.15**	−0.09*	0.14**	−0.36**	–	
23. on-task w4	−0.07	−0.10*	−0.12*	−0.11*	−0.13**	−0.09°	−0.19**	−0.13**	−0.10*	−0.02	−0.11*	0.03	−0.23**	−0.12*	−0.35**	0.05	0.07	−0.03	0.16**	−0.08°	0.16**	−0.12*	–
24. talking w4	0.06	0.03	0.06	0.10**	0.11*	0.10*	0.15**	0.10*	0.08°	−0.05	0.17**	−0.01	0.33**	0.11*	0.46**	−0.16**	−0.04	0.05	−0.10*	0.15**	−0.21**	0.19**	−0.34**

HB Hyperactive behavior, *OB* Oppositional behavior, *Remarks* Teacher negative remarks, *Praise* Teacher praise, *On-task* On-task behavior, *Talking* Talking-out behavior

° $p<0.10$. * $p<0.05$. ** $p<0.01$

and (male) sex. The results for hyperactive behavior are in the upper section of Table 4 (CFI /TLI=0.99/ 0.99, RMSEA=0.03). Intervention status was not related to the intercept of hyperactive behavior (β=0.07, p=0.15) indicating that control and GBG group did not differ in baseline levels of hyperactive behavior. A significant positive estimate of the slope factor mean showed that control group children had an increase in hyperactive behavior. The GBG had a marginally significant negative impact on the slope (β=−0.11, p=0.09), indicating a slower rate of increase of hyperactive behavior among GBG children compared to controls.

The results for oppositional behavior are in the lower section of Table 4 (CFI/TLI=0.99/0.97; RMSEA=0.05). The slope factor mean showed that, on average, no increases in oppositional behavior were found among control group children. The GBG had a significant negative impact on the slope (β=−0.15, p=0.04), indicating a decrease in oppositional behavior among GBG children.

Mediation of the Development of Hyperactive Behavior

An overview of the hypothesized full mediation model is presented in Fig. 1. The wave 2 and 4 teacher management and children's on-task and talking-out behavior were regressed on their preceding wave 1 and 3 values, respectively, and intervention status. Wave 2 and 4 on-task and talking-out behavior were further regressed on (male)sex and the intercept of hyperactive behavior (not shown in Fig. 1). They were also regressed on the wave 2 and 4 teacher behavior management variables respectively, to account for the hypothesized directional effect from teacher behavior management to children's classroom behavior. We first tested the non-mediation model, in which the slope of hyperactivity was not yet regressed on the wave 2 and 4 child behavior. This model had an adequate fit to the data (CFI/TLI=0.91/0.90, RMSEA=0.03). We then allowed for the mediation paths. In this model, the slope of hyperactive behavior was regressed on wave 2 and wave 4 on-task and talking-out behavior. Adding the second grade ($\Delta\chi^2(2)$=9.38, p=0.01) and third grade ($\Delta\chi^2(2)$=10.40, p=0.01) mediator paths significantly improved model fit. These paths were added to the model.

The mediation model had an adequate fit to the data (CFI/TLI=0.93/0.91; RMSEA=0.03). From the added paths in the mediation model, the paths from wave 2 (β=0.08, p=0.07) and wave 4 talking-out behavior (β=0.08, p=0.19) to the slope of hyperactive behavior were not significant. These paths were set to zero, which did not affect model fit. A graphical representation of the significant paths is given in Fig. 2. The model showed that the GBG significantly contributed to reductions in wave 2 teachers' negative remarks and increases in wave 2 child on-task behavior. Moreover, the reductions in negative remarks predicted increases in wave 2 on-task behavior, and wave 2 on-task behavior significantly contributed to the slope of hyperactive behavior. With the inclusion of these hypothesized mediating variables, the previously (marginally) significant negative direct effect of the GBG on the development of hyperactive behavior became non-significant. We estimated the significance of the indirect path of GBG on hyperactive behavior via wave 2 teacher negative remarks and wave 2 children's on-task behavior (MacKinnon et al. 2004). This indirect path was significant (β=−0.01, p=0.04). Although the strength of this indirect path may be considered small (Cohen 1988), these findings support the mediation of the development of hyperactive behavior by improved teacher and children's classroom behavior.

With regard to the other teacher and child behavior variables, it was found that they did not add to the mediation. Of the remaining wave 2 variables, the effect of the GBG on wave 2 praise (β=0.23, p=0.07) was not significant. Nor did wave 2 teacher praise have significant links with wave 2 on-task (β=−0.05, p=0.50) and talking-out behavior (β=0.01, p=0.92). With regard to the wave 4 variables, the GBG had a significant effect on (increased) wave 4 teacher praise, and teacher praise in turn significantly predicted (lower) wave 4 talking-out behavior.

Table 4 Parameter Estimates and Standard Errors for Hyperactive and Oppositional Behavior

	Intercept			Slope		
	B	SE	β	B	SE	β
Hyperactive behavior						
Growth factor mean	0.07	0.01	0.36***	0.02	0.01	0.22***
Intervention (GBG)	0.03	0.02	0.07	−0.02	0.01	−0.11°
Gender (male)	0.13	0.02	0.36***	0.02	0.01	0.10
Oppositional behavior						
Growth factor mean	0.05	0.01	0.31***	0.01	0.01	0.14
Intervention (GBG)	0.02	0.01	0.06	−0.02	0.01	−0.15*
Gender (male)	0.12	0.02	0.36***	0.03	0.01	0.21**

° p=0.09. *p<0.05. **p<0.01. ***p<0.001

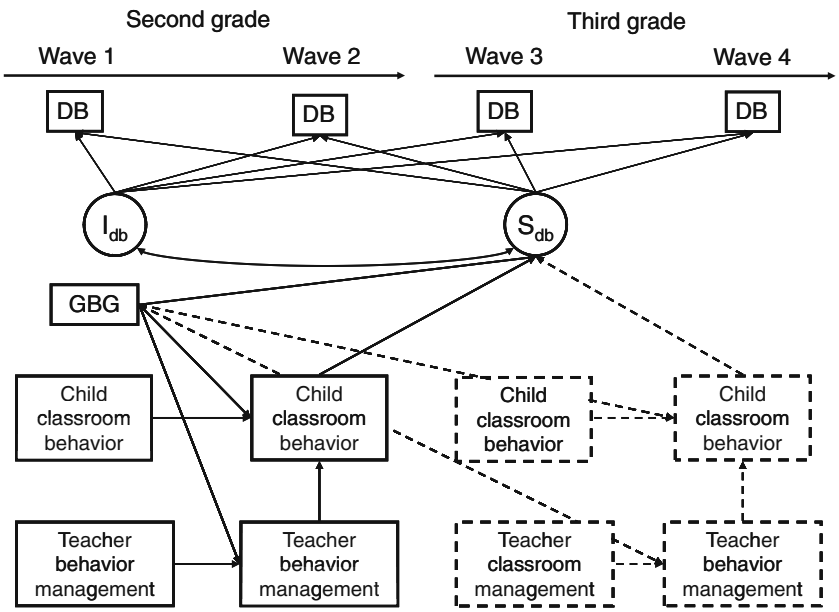


Fig. 1 Graphical representation of the hypothesized mediation model with teachers' and children's classroom behavior in second (*full lines*) and third grade (*dotted lined*) in the development of symptoms of disruptive behavior (DB; hyperactive or oppositional behavior)

However, only wave 4 on-task behavior significantly contributed to the slope of hyperactive behavior, but nor wave 4 teacher praise (β=0.02, p=0.72), nor the GBG (β=0.10, p=0.23) significantly contributed to wave 4 on-task behavior.

Finally, we tested for sex differences, using a multigroup model in which boys were compared to girls. All paths were freely estimated and we tested whether the paths that comprise the indirect pathway from GBG to the slope of hyperactive behavior were similar for boys and girls using a Wald test. The results showed there were no significant sex differences (*Wald*(4)=1.88, p=0.76).

Mediation of the Development of Oppositional Behavior

The mediation model of oppositional behavior was investigated in the same way as that of hyperactive behavior (see Fig. 1). The non-mediation model for oppositional behavior had an acceptable fit to the data (CFI/TLI=0.93/0.91, RMSEA=0.03). Allowing for the mediation path from second grade mediators to the slope of opposition improved model fit, $\Delta\chi^2(2)=6.11$, p=0.05. Adding the third grade mediators to the did not further improve model fit ($\Delta\chi^2(2)=2.61$, p=0.27). The third grade mediators were thus dropped from the oppositional model (the dotted lines in Fig. 1). The mediation model had an adequate fit to the data (CFI/TLI=0.98/0.97; RMSEA=0.03). From the added paths in second grade, the path from wave 2 on-task behavior to the slope of oppositional behavior was not significant (β=−0.07, p=0.34). This path was set to zero, which did not affect model fit. A graphical representation of the significant paths is given in Fig. 3. Significant GBG effects on wave 2 teacher negative remarks and child talking-out behavior were found, in addition to significant paths from wave 2 negative remarks to wave 2 talking-out behavior and from wave 2 talking-out behavior to the slope of oppositional behavior. A test of significance of the path from GBG via the mediators (teacher negative remarks and child talking-out behavior) to the slope of opposition showed this indirect pathway was significant (β=−0.01, p=0.04). The effect of the mediators in the development of hyperactive behavior was small (Cohen 1988). However, when taking the mediating variables into account, the previously significant negative direct effect of the GBG on the development (slope) of oppositional behavior was no longer significant.

The other variables in the model did not contribute to the mediation of the effect of the GBG on oppositional behavior. Like in the hyperactive model, there was no significant effect of the GBG on wave 2 praise (β=0.23, p=0.07). Nor did wave 2 teacher praise predict either of the child variables (on-task behavior: β=0.05, p=0.53; talking-out: β=0.00, p=0.99). We again tested for sex differences in the indirect effects by specifying a multiple group model for boys and girls separately. Again, no differences in path estimates were found (*Wald*(4)=6.38, p=0.17).

Alternative Mediation

First we tested if the mediation of the effect of the GBG on children's hyperactive and oppositional behavior could be explained by teacher variables only. Therefore, the children's classroom behavior variables as depicted in Figs. 2 and 3 were deleted from the models. This resulted into non-significant indirect effects via wave 2 remarks and wave 4 praise for hyperactive behavior (β=−0.04, p=0.18)

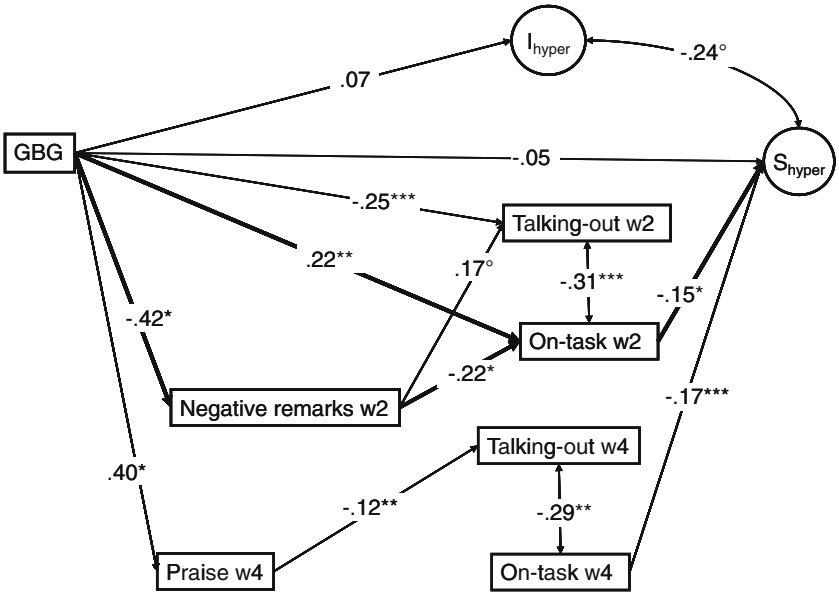


Fig. 2 Results of the mediation model testing possible associations between the Good Behavior Game (GBG), hyperactive behavior, observed wave 2 negative remarks and wave 4 praise of the teacher, and children's observed wave 2 and 4 on-task and talking-out behavior. Values on the single headed arrows reflect standardized regression estimates; values on the double headed arrows are correlations among residual variances of the variables. Paths in bolt display paths of the significant indirect effect. S_{hyper} = slope of hyperactive behavior; I_{hyper} = intercept of hyperactive behavior

and via wave 2 remarks for oppositional behavior (β=0.06, p=0.27). Second, we assumed a reversed path, in which children's classroom behavior affected teacher behavior. This resulted in non-significant indirect paths (β=−0.00, p=0.59; β=0.01, p=0.22 for hyperactive and oppositional behavior, respectively). Finally, we tested the indirect effect in which teachers were excluded. We thus tested whether children's improved classroom behavior alone mediated the effect of the GBG on children's disruptive behavior development. The indirect paths from the GBG to hyperactive behavior via wave 2 on-task behavior (β=−0.05, p=0.06) was marginally significant. The indirect path from the GBG to oppositional behavior via wave 2 talking-out behavior was also significant (β=−0.04, p=0.02). These findings suggest a second mediation process in second grade. The contribution of these mediations was small as well (Cohen 1988).

Discussion

The role of teacher behavior management in disruptive behavior development of young elementary school children was examined using a universal classroom preventive intervention study. The results showed a marginally significant reduced growth of hyperactive and a significant

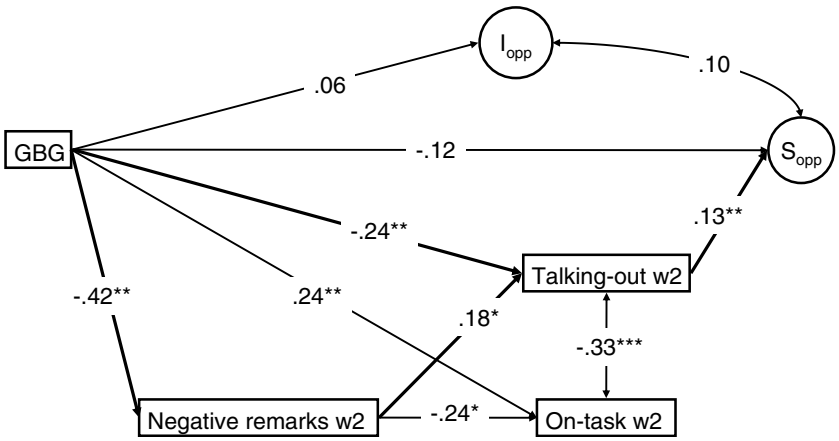


Fig. 3 Results of the mediation model testing possible associations between the Good Behavior Game (GBG), oppositional behavior, observed wave 2 negative remarks of the teacher, and children' observed wave 2 on-task and talking-out behavior. Values on the single headed arrows reflect standardized regression estimates; values on the double headed arrows are correlations among residual variances of the variables. Paths in bolt display paths of the significant indirect effect. S_{opp} = slope of oppositional behavior; I_{opp} = intercept of oppositional behavior

decrease in growth in oppositional behavior from the beginning of second to the end of third grade among GBG children, as compared to controls. This adds to previous findings on the effectiveness of the GBG in reducing disruptive behavior development (e.g., Ialongo et al. 1999, 2001; Kellam et al. 1994; van Lier et al. 2004, 2005; Witvliet et al. 2009). Furthermore, the GBG impacted teachers' classroom behavior in second and third grade. It was observed that second grade GBG teachers used less negative remarks and (marginally significant) more praise when managing children's classroom behavior at the end of the school year, as compared to the control teachers. Third grade GBG teachers used more praise compared to control group teachers. Two possible explanation can be given for why especially improvement in praise were found in the second intervention year, whereas mostly reduction in negative remarks in the first year. First, this may be a reflection of the success of the GBG in improving children's behavior, which likely became mostly visible in the second intervention year, when children had already received the GBG for almost 2 years. A second explanation may be that third grade teachers implemented the GBG in the *second* intervention year. This meant that, because children were already acquainted with the GBG, these teachers could more swiftly move to the expansion and especially the generalization phase. The use of praise during normal lessons, also when the GBG is not played is an explicit focus of the generalization phase. With regard to child classroom behavior, GBG children were more on-task and showed less talking-out behavior in the classroom at the end of the second grade than their control counterparts. These behaviors had fallen back to the levels of control children at the beginning of third grade. At the end of the third grade their classroom behavior again significantly improved, compared to control children. The improvements in observed child classroom behavior under influence of the GBG are consistent with earlier small-scaled studies (see Embry 2002; Tingstrom et al. 2006).

This study also provided unique insight into a pathway through which the GBG becomes effective. It showed that the reduced use of negative remarks of second grade GBG teachers predicted higher levels of on-task behavior among second grade GBG children, which subsequently explained the effect of the GBG on the development of hyperactive behavior. A similar result was found for oppositional behavior. GBG teachers used less negative remarks, which in turn predicted lower levels of talking-out behavior among GBG children, which accounted for the effect of the GBG on the development of oppositional behavior. These results support the hypothesis that the behavior management of the teacher, and the reduced use of negative remarks in particular, affects children's classroom behavior, which in turn contributes to the further development of hyperactive and oppositional behavior. These results were similar for boys and girls, suggesting that despite level differences, the effect of the negative remarks of the teachers and children's appropriate classroom behavior on hyperactive and oppositional behavior development may be sex-invariant. The effect of the GBG on teacher behavior management, on-task and disruptive classroom behavior, and their mediating role for the effect of the GBG on children's development of disruptive behavior had not been reported previously in large-scaled GBG research. Our findings thus confirmed and extended results from former GBG studies.

Not all variables contributed to the mediation of the effect of the GBG. First, our study showed that only second grade mediators accounted for the effect of the GBG on the development of disruptive behaviors over grades 2 and 3. Third year variables did not add to the explaining of the reduced growth of hyperactivity above and beyond the first intervention year variables. With regard to oppositional behavior, the third grade variables had no additive effect. This suggests that it are the initial changes made within the first intervention year, that accounted for the reductions in growth in hyperactive and oppositional behavior of these children, and emphasizes the importance of changing potential risk processes in classroom during the early years of elementary school. Second, in contrast to wave 2 negative remarks, the teachers' praise in second grade played no role in the development of disruptive behavior symptoms. This finding is inconsistent with earlier studies (e.g., Ferguson and Houghton 1992; Sutherland et al. 2000), but in line with previous research showing that the negative aspects in teacher-child interactions are more important for children's disruptive behavior development compared with the positive aspects (e.g., Ladd et al. 1999). Moreover, although GBG teachers used (marginally) significantly more praise at the end of the second and third grade than that of the control teachers, GBG teachers still only reacted with praise to appropriate child behavior at (on average) one or two occasions during the three ten-minute observation intervals. Previous research showed that while most teachers understand the importance of attending to appropriate child behavior, they fail to praise these behaviors (Van Acker et al. 1996). Our findings thus support the notion that teachers may need more support implementing behavior specific praise (Stormont 2002). Finally, children's on-task behavior did not significantly contribute to oppositional behavior, whereas talking-out behavior did not significantly add to hyperactive behavior. This shows that although both classroom behavior are linked to oppositional behavior (Ducharme and Harris 2005) and hyperactive behavior (Kofler et al. 2008), these classroom behaviors had no predictive power for the concerned behavior development over time. Moreover,

these findings show that the relevant classroom behaviors of children were different for hyperactive and oppositional behavior development.

This study also showed that second grade teachers' negative remarks were only indirectly linked to hyperactive and oppositional behavior. Reduction in negative remarks of the teacher itself did not account for the effect of the GBG on disruptive behavior development. Moreover, although the reduced use of negative remarks predicted the improvements in classroom behavior among GBG children, a direct GBG effect on children's classroom behavior in second grade was found as well. In other words, the effect of the GBG on hyperactive and oppositional behavior development was accounted for by two mediation processes in second grade. This finding implies that changing the teacher's behavior management is just one possible way to set off the chain of following events to the development of disruptive behavior, while the change in the children's classroom behavior may be an essential step in changing the development of hyperactive and oppositional behavior. These findings are in line with the hypothesis outlined by Dishion and colleagues (1995), that disruptive behavior can be seen as an aggregation of many concrete behaviors, such as on-task and talking-out behavior, formed by social interactions with parents, peers, teachers, and other socialization agents. Perhaps other aspects within the classroom context, like peer relations were changed by the GBG and affected children's behavior as well. Indeed, Witvliet and colleagues (2009) found peer acceptance to be an intervening variable of the effect of the GBG on the development of children's externalizing behavior.

Taken together, our results extend the findings of previous studies investigating the link between teacher behavior management and children's behavior in two ways. First, negative remarks were not only linked to children's immediate classroom behaviors but also to their further disruptive behavior development in early elementary school. Second, the results from this study come from a randomized controlled preventive intervention program. We thus tested whether altering the hypothesized intervening processes, teacher behavior management and children's classroom behavior, resulted into changes in the development of hyperactive and oppositional behavior. This approach is essential for establishing causal mechanisms (Flay et al. 2005).

Some limitations should be considered when interpreting these results as well. First, children were followed for only 2 years. Follow-up of the sample is needed to determine possible prolonged effects of the GBG. With regard to the sample, most of the children had a Flemish Belgian background, making the sample ethnically homogenous. Studies with more ethnically diverse samples are needed before these findings can be generalized. A second limitation concerns the design of this study. The improvement in teacher management and children's classroom behavior were assessed concurrently, at the end of each school year. This makes it impossible to make conclusions with regard to the direction of effect between teacher management and children's classroom behavior. Although this direction is plausible based on theory, the focus of the GBG with teachers as the mode of intervention, and given that the model from teacher behavior to child behavior was significant and the model with the opposite effect was not significant, we cannot be certain of this.

Third, the observers of teacher and child classroom behavior were not always blind to the intervention status of the classroom, mostly because teachers or children revealed the intervention status of their class. In addition, it was not noted toward which specific child a negative remark or the praise of the teacher was directed at, while it has been shown that teachers react to children differently (e.g., Nelson and Roberts 2000; Van Acker et al. 1996). Due to practical considerations, it was not possible to assess dyadic interaction between teachers and children. Such dyadic interactions may have given additional valuable information. Furthermore, the length of the child observations were short (6 times 20 s, one morning), which probably limited the possibility of observing the occurrence of the disruptive behaviors (taking-out and out-of-seat behavior), which may have contributed to the lack of finding a GBG effect on out-of-seat behavior. In addition, the lack of GBG effects on out-of-seat behavior may also have been due to the very strict observation system, in which even small movements were tallied on the observation sheet (i.e., not reflecting actual out-of-seat behavior).

Finally, the mediators only accounted for a small proportion of the variation in children's symptoms of hyperactive and oppositional behavior development. One explanation could be the use of different informants, where *observed* teacher and child behavior were used as mediators of the development *peer rated* disruptive behavior. Another explanation could be that other possible mediation variables that may have been triggered by the GBG, such as increasing classroom structure and predictability, and improving peer relations (see Witvliet et al. 2009), were not accounted for. When adding such variables, the overall effect size of the influence of mediating process in the effect of the GBG on disruptive behavior development may increase.

Despite these and possible other limitations, the present results provide new and valuable insights into the role of teacher behavior management in the development of disruptive behavior symptoms in elementary school and have implications for future research and preventive practice. It should be noted that some effects in the hyperactive model were marginally significant (but not for opposition), so further research is needed to underpin these

implications. Our results suggest that future studies should include different factors in a chain of events leading to (behavioral) development, which may result into a differentiated view of the (behavioral) development with some factors being crucial components while others are not. Also, our study implies that improving teacher behavior management is one way to ameliorate the development of hyperactive and oppositional behavior, via its effect on children's classroom behavior. Hence, our findings support the notion put forth by school psychologists, that to improve child functioning, attention can be focused on improving the professional functioning of the adults, such as teachers, so they can prevent and/or respond more efficiently to problems (e.g., Gutkin and Curtis 2009). In everyday schools, teachers still frequently use reprimands and negative remarks, and use low rates of appropriate reinforcement of behavior (e.g., Shores et al. 1993; Wehby et al. 1995). This has been shown to be linked to disruptive behavior development among children. Our results demonstrate that reductions in negative teacher management behaviors are linked with reductions in children's disruptive behaviors, thus underscoring the potential of guiding teachers in using effective classroom management strategies. This is even more the case as teachers usually have a positive attitude toward (teacher management) interventions, using praise and cues for appropriate behavior (Gunter and Coutinho 1997). It is therefore important that professionals work with teachers to help them support and respond to students in a manner that increases positive behavior and reduces inappropriate behavior.

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