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Individual differences in effects of child care quality: The role of child affective self-regulation and gender

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ABSTRACT

The current study investigated whether the relation between child care quality and children's socio-emotional behavior depended on children's affective self-regulation skills and gender. Participants were 545 children (M_{age} = 27 months) from 60 center-based child care centers in the Netherlands. Multi-level analyses showed that children with low affective self-regulation skills or who were male demonstrated less teacher-rated social competence when exposed to relatively low quality child care. In addition, children with low affective self-regulation skills also showed more social competence in the case of relatively high quality child care, suggesting mechanisms of differential susceptibility. No main effects of child care quality or interactions were found for teacher- and parent-rated externalizing behavior. These findings emphasize the importance of considering children's affective self-regulation skills and gender in understanding the effects of child care quality. High quality child care can be a means to strengthen children's social development.

1. Introduction

Research on the effects of early child care quality has indicated that high process quality child care (e.g., child–teacher relationships and interactions) is prospectively related to more social competence and fewer behavior problems in children (Burchinal et al., 2008; Mashburn et al., 2008; NICHD ECCRN, 2006; Peisner-Feinberg et al., 2001), with effects sometimes even lasting into adolescence (Vandell, Belsky, Burchinal, Steinberg, & Vandergrift, 2010). However, several of these studies also found null effects for some of the socio-emotional outcome measures (NICHD ECCRN, 2006; Peisner-Feinberg et al., 2001; Vandell et al., 2010), and a recent meta-analytic study by Keys et al. (2013) of four large-scale studies in the U.S. showed that child care and preschool process quality were not reliably associated with children's social skills and problem behaviors one year later. One possible explanation for these mixed findings is that children's individual characteristics might moderate these effects (Crockenberg, 2003; Phillips, Fox, & Gunnar, 2011). The current study addresses this issue by examining whether child affective self-regulation skills and gender moderate the link between child care quality and children's socio-emotional development.

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1.1. Child care × temperament

The past two decades has experienced tremendous growth of the number of empirical studies that focus on the interactions between child temperamental characteristics and environmental influences in relation to children's socio-emotional development (Rothbart & Bates, 2006). Most early studies investigated hypotheses derived from a *dual-risk* framework (Sameroff, 1983) in which children with certain temperamental characteristics (e.g., a difficult or reactive temperament) were viewed as more *vulnerable* for adverse environmental influences, compared to children with other temperamental characteristics who were viewed as more resilient. However, evidence has emerged that this multiple risk framework may only be one side of the story. The more recently developed *differential susceptibility hypothesis* proposes that some children are not only more vulnerable for adverse environments, but in general are more *susceptible* to both negative and positive environmental influences compared to their less susceptible counterparts (e.g., Belsky, 1997; Belsky et al., 2007).

Most evidence for either dual-risk or differential susceptibility for children's socio-emotional development comes from studies on parenting by temperament interactions (for reviews, see e.g., Kiff, Lengua, & Zalewski, 2011; Pluess & Belsky, 2010). However, evidence has emerged that effects of early child care experiences might also vary depending on children's temperamental dispositions (e.g., Phillips et al., 2011; Pluess & Belsky, 2010). Temperament is a multi-dimensional construct with somewhat diverging definitions across studies (e.g., Nigg, 2006; Rothbart & Bates, 2006). In the current study, we follow Rothbart and Bates (2006) who define temperament as "constitutionally based individual differences in reactivity and self-regulation, in the domains of affect, activity, and attention". Within this definition, *reactivity* refers to the "responsiveness to change in the external and internal environment", and *self-regulation* to "processes such as effortful control and orienting that modulate reactivity" (Rothbart & Bates, 2006, p. 100). Most child care studies investigating the moderating role of child temperament have focused on child *reactivity*. For structural child care characteristics (e.g., type and amount of care), it is found that infants with a reactive temperament exhibited more externalizing and internalizing problems as toddlers if they attended center-based child care in the first year of life (Beijers, Riksen-Walraven, Putnam, de Jong, & de Weerth, 2013) or spent long hours in center-based child care (Crockenberg & Leerkes, 2005). In addition, attending several parallel child care arrangements was related to more internalizing, but not externalizing behavior problems in toddlers rated as highly reactive as infants (De Schipper, Tavecchio, Van IJzendoorn, & Van Zeijl, 2004). These studies found no or weak effects on child behavior problems for less reactive children. It should be noted, however, that results are not consistent across studies, as child reactive temperament did not moderate the relation between hours in child care or early center-based child care attendance and child socio-emotional adjustment in other studies (e.g., Bates et al., 1994; Pluess & Belsky, 2009, 2010).

Next to structural child care quality characteristics, other studies have found evidence that child reactive temperament moderated child care process quality characteristics. Children with a relatively difficult or reactive temperament as infants or toddlers were less involved in contacts with peers (Almas et al., 2011; Deynoot-Schaub & Riksen-Walraven, 2006; Phillips et al., 2012) and exhibited more behavior problems and less social competence (Pluess & Belsky, 2009), when exposed to low quality child care compared to their more easy or less reactive counterparts. That is, children's reactive or difficult temperament functioned as a vulnerability for low quality child care. However, in two of these studies, reactive children showed fewer behavior problems (Pluess & Belsky, 2009) and were more socially integrated with peers (Phillips et al., 2012) when they were exposed to high quality care, indicating mechanisms of differential susceptibility rather than dual-risk. One study did not find evidence for moderation by child reactive temperament for teacher-rated behavior problems (Phillips et al., 2012). Thus, although evidence is accumulating that child reactive temperament is probably an important moderator of early child care quality, results have not been completely consistent across studies.

1.1.1. Child care × affective self-regulation

Despite the increasing number of studies exploring child temperament as a moderator of early child care effects, none of these studies has to our knowledge specifically focused on the moderating role of child *self-regulation*. Research on parenting by self-regulation interactions suggests that individual differences in early self-regulation skills are probably an important moderator for socialization influences. Several studies found stronger associations between negative parenting behaviors and child externalizing behaviors for young children rated as low on self-regulation, compared to children rated as average or high on self-regulation (e.g., Morris et al., 2002; Rubin, Burgess, Dwyer, & Hastings, 2003). For positive parenting behaviors, one study showed that less parental positive control was related to more externalizing behavior, but only when toddlers scored low on effortful control (Karreman, van Tuijl, van Aken, & Deković, 2009). The results of these studies were more in line with the dual-risk model, with low levels of self-regulation only operating as a risk factor for more adjustment problems in the case of more negative or less positive parenting behaviors, and not as a susceptibility factor in the case of less negative or more positive parenting behaviors. The current study is designed to extend these results by exploring if, and if so how, child self-regulation moderates the effects of child care quality on child socio-emotional development.

In recent years, the interest in child self-regulation has tremendously increased, as it has been associated with a host of positive child developmental outcomes such as more social competence (Calkins, Gill, Johnson, & Smith, 1999; e.g., Spinrad et al., 2007), fewer behavior problems (Eisenberg et al., 2009; Spinrad et al., 2007; Willoughby, Kupersmidt, Voegler-Lee, & Bryant, 2011), better academic outcomes (Blair & Razza, 2007; Graziano, Reavis, Keane, & Calkins, 2007), and stronger conscience development (Kochanska & Knaack, 2003). Moreover, one study has shown that positive behavioral effects of early self-regulation persist at age 32 years (Moffitt et al., 2011). However, there is considerable disagreement between researchers on how to define and measure child self-regulation, which has led to a plethora of tasks assumed to measure self-regulatory

skills. A conceptual framework that has become more prevalent over the past 10 to 15 years across different disciplines is the distinction between *hot* and *cool* characteristics of self-regulation (Allan & Lonigan, 2014; Metcalfe & Mischel, 1999; Willoughby et al., 2011; Zelazo & Carlson, 2012). Whereas child hot self-regulation capacities are presumably activated when an affectively salient component is involved that needs to be regulated (e.g., delay of gratification tasks, response-gain tasks), child cool self-regulation is activated when there is no such salient component present (e.g., motor inhibition or Stroop-like tasks). Several studies showed that these hot (i.e., affective) and cool self-regulation tasks indeed load onto two different, although correlated factors in toddlers and young children (e.g., Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009; Kim, Nordling, Yoon, Boldt, & Kochanska, 2013; Murray & Kochanska, 2002; Willoughby et al., 2011). Furthermore, studies have shown differential relations with child outcomes, with hot, affective self-regulation tasks being a stronger predictor of children's socio-emotional outcomes, and cool self-regulation tasks being better predictive of children's academic outcomes (Kim et al., 2013; Willoughby et al., 2011). Moreover, several studies indicate that low levels of child affective self-regulation can be seen as an indicator for genetic risk or endophenotype for developing serious behavior problems (Casey et al., 2011; Gagne, Saudino, & Asherson, 2011; Utendale & Hastings, 2011). Because of these stronger relations of hot, affective self-regulation to children's later socio-emotional development, the current study will focus specifically on child affective self-regulation skills.

From the summarized research, it can be hypothesized that effects of early child care quality will vary for children depending on their affective self-regulation capacities. To our knowledge, there are no studies that have examined this link among toddlers and preschoolers. However, there is one study that addressed this question within a sample of kindergarten children (Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009). No interactions were found between three indicators of kindergarten classroom quality (emotional support, classroom management, and instructional support) and a composite of three self-regulation tasks assessed upon kindergarten entrance for teacher-rated child adaptive classroom behaviors at the end of the kindergarten year. This could be due to the fact that the self-regulatory composite consisted of two delay of gratification (affective) tasks and a motor inhibition (cool) task. Moreover, it is plausible that affective self-regulation skills assessed during the toddler years are more strongly predictive of child socio-emotional development than child affective self-regulation skills assessed at age five to six years, which are probably already more influenced by socialization efforts such as parenting (Lengua, Honorado, & Bush, 2007; Spinrad et al., 2007). The present study addresses these issues by examining whether specifically child affective self-regulation at age two (assessed with delay of gratification tasks) moderates the association between early child-care quality assessed at age two and child socio-emotional development one year later.

1.2. Child care × gender

In addition to child temperament, several studies have investigated whether child gender functions as an individual characteristic by which effects of early child care on child socio-emotional development might vary. Although several studies have found no evidence for moderation by gender (Belsky et al., 2007; Burchinal, Peisner-Feinberg, Bryant, & Clifford, 2000; Keys et al., 2013), others have demonstrated that high quality child care was more strongly related to fewer behavior problems in boys (Howes & Olenick, 1986; Votruba-Drzal, Coley, Maldonado-Carren, Li-Grining, & Chase-Lansdale, 2010; Votruba-Drzal, Levine Coley, & Chase-Lansdale, 2004), with less strong or even no effects of child care quality found for girls. As empirical studies show that boys score lower on self-regulatory abilities than girls (e.g., Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006), several researchers have suggested that boys may need high quality, well-structured child care environments with more sensitive and responsive caregivers more than girls as they may need an external source of regulation of their behaviors and emotions (Crockenberg, 2003; Votruba-Drzal et al., 2010, 2004). To our knowledge, however, no study has investigated whether lower self-regulatory abilities are indeed what make boys benefit more from high quality child care, or whether there is something else about being a boy that accounts for this higher responsiveness to high quality child care. The current study directly tests this hypothesis by examining concurrently whether the link between high process quality child care and child socio-emotional development one year later depends on child affective self-regulation skills and gender.

1.3. Hypotheses

The studies conducted to date suggest the possible moderating effect of child affective self-regulation and provide inconsistent evidence for the moderating effect of child gender on the relation between child care process quality and children's socio-emotional development. Following from the results on parenting by self-regulation interactions, we hypothesize that children with low levels of affective self-regulation would be more *vulnerable* to low quality child care. That is, they exhibit higher levels of behavior problems and lower levels of social competence compared to children scoring average to high on affective self-regulation (i.e., the dual risk model). However, next to this hypothesis, we also explored whether these less well regulated children were more *susceptible* to high quality child care. That is, they exhibit lower levels of behavior problems and higher levels of social competence compared to children scoring average to high on affective self-regulation (i.e., the differential susceptibility model). For child gender we hypothesize that boys would be more vulnerable to low quality child care (i.e., higher levels of behavior problems and lower levels of social competence). However, we expect that this effect is not significant anymore when introducing affective self-regulation into the model (i.e., that the effect could be accounted for by the lower self-regulatory abilities of boys).

2. Method

2.1. Procedure

The current study uses data from the first two measurement moments of pre-COOL (Veen et al., 2012), an ongoing longitudinal cohort study on the effects of early childhood education and care in the Netherlands. Participants of the study were recruited through 139 primary schools that participate in another longitudinal cohort study examining the effects of investments in primary education. These schools provided contact details of 350 centers and an additional 152 centers were approached through several other sampling procedures (e.g., directly approaching large child care organizations). In total, 260 of the 502 approached centers (51.8%) agreed to participate in the cohort study; 75 center-based child care centers, 180 preschools, and 5 centers that provide both types of care. In the Netherlands, center-based child care centers (0 to 4 years) provide child care during parental working hours and children attend on average two to three days per week (Veen, Roeleveld, & Heurter, 2010). In contrast, preschools (2 to 4 years) focus on preparing children for primary education (starting at age 4) and are visited for two to five half-days a week. Although participating centers were somewhat more often located in urban municipalities (70.9% versus 55.0%), the ratio of participating and nonparticipating centers over different national regions (north, east, south, and west) was approximately the same.

Within the participating centers, parents of all children turning two within half a year were personally informed by the child's teacher about the pre-COOL study and were given a detailed letter, which outlined the opportunity to withdraw their child from study participation. Parents of 1712 (91.2%) children agreed with the child's participation. These children were individually assessed (e.g., executive functioning, language skills), and both their teachers and parents received a questionnaire about affective, socioeconomic and general family and child characteristics. Observations of the social, emotional and educational climate of child care classrooms were made using the CLASS Toddler (e.g., La Paro, Hamre, & Pianta, 2011). Classrooms where at least four children participated were observed with the CLASS, between one and seven months after the children were tested.

For the current study, we only used data from children in observed center-based child care settings ($n = 793$) and not from children in observed preschools, because these settings serve different populations and diverge in set-up. Moreover, we wanted to examine both cross-sectional (at T1, age 2) and longitudinal associations (at T2, age 3) with child care quality, and children in preschools (which starts at age 2 or 2,5) were only enrolled for a very short period of time at the age 2 assessment, compared to those enrolled in center-based child care.

2.2. Participants

Data were used from children for whom at least information about the CLASS, child affective self-regulation and gender (i.e., the main predictors) was available at T1 ($n = 647$). We estimated a model for teacher-rated outcomes and for parent-rated outcomes. For the teacher-rated outcomes model, only children with teacher reports at T1 and/or T2 were included ($n = 545$). These 545 children were distributed over 59 child care centers, with approximately nine children per center ($M = 9.2$, range: 1–18, with two exceptions of 23 and 24). When we compared these children to children with no teacher-reports ($n = 102$, 19%), there were no significant differences in children's scores on working memory, selective attention, delay of gratification and vocabulary tasks at T1, $F(4, 547) = 0.48$, $p = .751$. For the parent-rated outcomes model, we also included the children with parent reports at T1 and/or T2 ($n = 392$). These 392 children were distributed over 60 child care centers, with approximately six children per center ($M = 6.5$, range: 1–14, with one exception of 21). When we compared these children to children with no parent reports ($n = 255$, 39%), there were also no significant differences in children's scores on a working memory, selective attention, delay of gratification and vocabulary task at T1, $F(4, 547) = 1.18$, $p = .318$.

A description of the background characteristics of these two largely overlapping samples ($n = 361$) is given in Table 1. The percentages for parental educational level and ethnic minority status are in line with statistics that show that child

Table 1
Characteristics of the samples.

	Parent-rated outcomes model ($n = 392$) %	Teacher-rated outcomes model ($n = 545$) %
Age (months)	27.16 (2.42)[a]	27.56 (2.60)[a]
Gender (girl)	46.2	46.6
Ethnic minority status		
Dutch/Western	91.4	90.9
Non-western immigrant	8.6	9.1
Parental educational level		
Lower vocational or less	5.6	7.1
Average vocational	24.9	25.1
College or more	69.5	67.8
Enrollment center-based child care before age 1	79.5	78.5
Days in center-based child care at T1 (age 2)	2.33 (0.91)[a]	2.33 (0.91)[a]

Note. The valid percentages are reported.
[a] Mean and standard deviation.

Table 2
Descriptive statistics of child outcomes at time 1 (T1) and time 2 (T2).

Child outcomes	T1–age 2				T2–age 3			
	N	*M*	*SD*	Range	*N*	*M*	*SD*	Range
Teacher report								
Externalizing behavior	378	2.11	0.74	1.00–4.75	388	2.08	0.70	1.00–4.40
Social competence	383	3.87	0.46	1.71–5.00	391	4.03	0.49	2.20–5.00
Parent report								
Externalizing behavior	297	2.16	0.60	1.00–3.80	261	2.26	0.50	1.20–3.60

Note: For teacher reports, 545 children had reports on T1 and/or T2, with 42% ($N = 230$) having both T1 and T2 reports. For parent reports, 392 children had reports on T1 and/or T2, with 44% ($N = 171$) having both T1 and T2 reports.

care centers in the Netherlands are most often visited by children from higher educated families (cf., Veen et al., 2010). The average intensity of center-based child care in this study is 2.33 days per week ($SD = 0.91$, range: 1–5 days), which is representative for the Dutch population (Veen et al., 2010). A summary of the available teacher and parent reports of child socio-emotional outcomes is given in Table 2. There were no significant differences on children's socio-emotional outcomes and affective self-regulation skills at T1 when comparing children with only teacher report on T1 with children with also teacher report at T2, $F(4, 373) = 0.77$, $p = .274$. A similar picture emerged for the parent reports, $F(3, 293) = 0.37$, $p = .774$.

2.3. Measures

2.3.1. Child care quality (T1—age 2)

Child care process *quality* was assessed with the CLASS Toddler (La Paro et al., 2011; Thomason & La Paro, 2009). The CLASS Toddler is an age-adapted version of the widely used CLASS pre-K (Pianta, La Paro, & Hamre, 2008) and comprises eight dimensions, fitting two higher order domains: *emotional and behavioral support* and *engaged support for learning*. Each classroom was observed for four 20-min cycles during a three- to four-hour morning visit. To create center-level dimension scores, observation scores were averaged over all observation cycles within a child care center.

Research-assistants were trained in the CLASS Toddler by a certified trainer. After receiving oral and written instructions, assistants completed an online reliability test by scoring five standard video fragments using an approved Dutch translation of the standardized CLASS manual (Slot, Leseman, Mulder, & Verhagen, 2013). Observers passed the reliability test when dimension scores reached a within one point agreement of 80% with the master coder ($M = 86.4\%$). Next, assistants conducted a live-observation together with a certified CLASS observer. The mean reliability (i.e., within one point agreement) of these live observations was 89.9%. All classrooms were observed within a three-month period after the assistant was trained.

For the current study, only the domain emotional and behavioral support was used, given our interest in child social and emotional well-being. The domain emotional and behavioral support consists of five dimensions: positive climate, negative climate, teacher sensitivity, regard for child perspectives, and behavioral guidance. In line with a study by Pakarinen et al. (2010), we excluded the dimension negative climate, because there was almost no variance on this dimension ($M = 1.18$, $SD = 0.23$, range: 1.00–2.00), and inclusion decreased the variability of the total domain. Assistants rated all dimensions on a 7-point rating scale, with 1 and 2 reflecting a low; 3, 4 and 5 reflecting a medium; and 6 and 7 reflecting a high score. These dimension scores were averaged per center to result in a mean score of $M = 5.01$ ($SD = 0.58$, range 2.97–6.09). Cronbach's alpha of the domain was .78.

2.3.2. Child affective self-regulation (T1—age 2)

Child affective self-regulation was assessed with two delay of gratification tasks (snack delay and gift delay), from the widely used effortful control battery of Kochanska, Murray, and Harlan (2000), which were adapted for field-based research with two-year olds (Mulder, Hoofs, Verhagen, van der Veen, & Leseman, 2014; Mulder, Verhagen, & Leseman, 2012). The two delay tasks were individually assessed in a quiet room at the child care center, and were part of a larger battery of tests examining children's executive and language functioning. To secure standardized assessment, research assistants attended a one-day test administration course and submitted a video on which they administered the battery to a two-year-old. This video was reviewed and each assistant got a feedback report which was discussed by phone.

During the delay tasks, an open box of raisins or a wrapped gift was placed in front of the child on a table and children were asked to not touch the box or gift until the assistant had finished another task. The assistant then moved away from the child and sat behind him/her at a short distance, slightly turned away, to discreetly observe and code the child's behavior for 1 min. For the snack delay task, three behavioral categories were scored: touching behavior, picking up the box of raisins and eating the raisins (0 = present, 1 = not present; range 0–3). For the gift delay, only touching the gift or bow and tearing the wrapping paper were scored (range 0–2), because unwrapping the gift was too difficult for children this age. High scores on both tasks reflected better abilities to delay. In a separate study, video-recorded observations of the delay tasks were coded ($n = 53$) to determine the reliability of the live codes. Kappa's ranged from .74 to .95 and agreement between video and live codes was >94% for all behavioral scores. For more details about the tasks, coding, and the reliability study, see Mulder et al. (2014).

We used Confirmatory Factor Analysis (CFA) in Mplus 7.11 (Muthén & Muthén, 2013) with Full Information Maximum Likelihood Estimation (FIML) to create a latent factor score addressing children's affective self-regulation skills (indicated by the two delay of gratification tasks) for all children in the pre-COOL study (Mulder et al., 2014). A second latent factor score representing more cool self-regulation skills was created within the same factor model, but in the current study we focus only on the affective self-regulation factor score. The Comparative Fit Index (CFI) for the model was .996, and the root mean square error of approximation (RMSEA) was .022 In general, a CFI of $\geq$.95 and RMSEA of $\leq$.05 indicate good model fit (Hu & Bentler, 1999). Comparable models including a hot and cool component have been identified in other empirical studies (e.g., Kim et al., 2013; Willoughby et al., 2011). The latent hot or affective self-regulation factor scores ranged between −1.07 and 0.69, with a mean score of 0.00 (SD = 0.50).

2.3.3. Child externalizing behavior (T1—age 2 and T2—age 3)

Parents and teachers reported on child externalizing behavior using five items from the problems scale of the Brief Infant-Toddler Social and Emotional Assessment (BITSEA; Briggs-Gowan & Carter, 2002). The BITSEA is a widely used screening instrument for 1- to 3-year-old children at risk for socio-emotional problems (Briggs-Gowan, Carter, Irwin, Wachtel, & Cicchetti, 2004). Sample items are "your child. . . is restless and can't sit still", and ". . .hits, shoves, kicks or bites children (not including brother/sister)". The items were rated on a 5-point scale ranging from 1—*never* to 5—*always*. Cronbach's alpha was .73 at T1 and .68 at T2 for parent reports, and .82 at T1 and .86 at T2 for teacher reports. Mean scores were computed and used in further analyses when parents and teachers rated at least four out of five items on externalizing behavior. Correlations between parent and teachers reports were .30 at T1 ($p < .001$) and .36 at T2 ($p < .001$), which is consistent with the literature on multi-informant data (e.g., Kerr, Lunkenheimer, & Olson, 2007). Analyses are presented for teacher and parent reports separately.

2.3.4. Child social competence (T1—age 2 and T2—age 3)

Teachers reported on children's social competence through seven items of the BITSEA Competence scale (Briggs-Gowan & Carter, 2002). Sample items are "your child. . . looks for you (or other teacher) when upset", ". . .plays well with other children", and ". . .tries to help when someone is hurt (e.g., gives a toy)" (α = .74). At T2, teachers filled out five of the seven[1] items assessed at T1 (α = .75). The mean scores were computed when teachers responded to at least six out of seven items on social competence at T1 and four out of five items at T2.

2.3.5. Covariates

To control for possible social selection effects, which are inherent to early child care research (NICHD ECCRN & Duncan, 2003), we selected the following six covariates: Child ethnic minority status, enrollment in center-based child care before age 1, low and high family educational level (all dummy variables), child care quantity and child age (continuous variables). Furthermore, by controlling for child outcomes at T1 we diminished the effects of possible selection bias when predicting outcomes at T2.

2.4. Analysis strategy

Multilevel analysis (Hox, 2010; Snijders & Bosker, 2012) was used to investigate whether center emotional and behavioral support interacted with child affective self-regulation (both assessed at T1) and child gender in predicting child socio-emotional outcomes at both T1 and T2 (i.e., cross-sectional and longitudinal while controlling for T1 behaviors). Our data has a two-level structure with child and family characteristics at level 1 and center emotional and behavioral support at level 2. We used Mplus 7.11(Muthén & Muthén, 2013) to estimate a series of multilevel models for all teacher-rated outcomes simultaneously and for all parent-rated outcomes simultaneously (i.e., child externalizing behavior and social competence at both T1 and T2). An advantage of analyzing all outcome variables simultaneously (i.e., structural equation modeling), is that we could account for the covariances between the outcomes at T1 and the covariances between the residualized outcomes at T2 at both the within- and between-level. Moreover, missing data was addressed by using Full Information Maximum Likelihood (FIML) as an approach for model estimation (Enders, 2010). This FIML estimation will be more accurate when more relevant information is included within the model. FIML has been recommended as one of the most appropriate ways of dealing with possible selective attrition (e.g., Asendorpf, van de Schoot, Denissen, & Hutteman, 2014; Enders, 2010). Moreover, simulation studies show that FIML provides less biased regression parameter estimates compared to other missing data procedures (Enders, 2001; Olinsky, Chen, & Harlow, 2003). To account for possible non-normality in the outcome variables, models were estimated using FIML with robust standard errors.

In the first model, the *Null Model*, we estimated the amount of variance in the outcomes at both T1 and T2 at the child (level 1) and center level (level 2). In the next model, the *Full Model*, we included child affective self-regulation and gender (level 1), the child- and family covariates (level 1), and center emotional and behavioral support (level 2) as predictors. Furthermore, we controlled for child outcomes at T1 (level 1) when predicting child outcomes at T2 (i.e., estimating residualized change

[1] "follows rules" and "hugs or feeds dolls or stuffed animals" were not assessed.

Table 3
Correlations (*r*) between main predictor and outcome variables.

	1	2	3	4	5	6
Center level (level 2)						
1. Emotional and behavioral support T1	–	−.06	−.05	n/a	.05	n/a
Child level (level 1)						n/a
2. Affective self-regulation T1	−.04	–	.02	n/a	−.11	n/a
3. Externalizing behavior T1	.01	−.15***	–	n/a	.50***	n/a
4. Social competence T1	−.04	.16***	−.32***	–	n/a	n/a
5. Externalizing behavior T2	.04	−.16***	.50***	−.24***	–	n/a
6. Social competence T2	.09	.04	−.16***	.29***	−.45***	–

Note: Correlations for the model with parent-rated outcomes are above the diagonal. Correlations for the model with the teacher-rated outcomes are below the diagonal. n/a = not applicable, because this information was not available at T1.
*** $p < .001$.

Table 4
Null Model and Intra-Class Correlations (ICC) of teacher-rated externalizing behavior and social competence at time 1 (T1) and time (T2).

	Externalizing T1	Social competence T1	Externalizing T2	Social competence T2
Variance components				
Level 2—center	.029	.025	.048	.022
Level 1—child	.512	.188	.445	.220
ICC	.054	.117	.097	.091

Note: ICC = Intra-Class Correlation.

Table 5
Null Model and Intra-Class Correlations (ICC) of parent-rated externalizing behavior at time 1 (T1) and time (T2).

	Externalizing T1	Externalizing T2
Variance components		
Level 2—center	.004	.010
Level 1—child	.357	.236
ICC	.011	.041

Note: ICC = Intra-Class Correlation.

models). Third, in the *Slopes as Outcomes Model*, we included center emotional and behavioral support as a predictor of the slope parameters of child affective self-regulation and gender (i.e., the cross-level interactions). Continuous predictors were centered on the grand mean in the Slopes as Outcomes model to avoid multicollinearity problems (Cohen, Cohen, West, & Aiken, 2003). Finally, we compared this Slopes as Outcomes Model with a *Random Slopes Model* (i.e., without center emotional and behavioral support as a predictor of the slope parameters) and the Full Model with the Akaike Information Criterion (AIC, Akaike, 1973), to decide which model fits the data best. Model equations for these types of multilevel regression models can be found in Hox (2010).

3. Results

Descriptive statistics of the study's outcome variables and correlations between the study's main predictor and outcome variables are presented in Tables 2 and 3, respectively. The correlations between the outcomes at T1 and T2 indicated moderate to strong stability. Child affective self-regulation at T1 was positively related to teacher-rated social competence at T1 and negatively related to teacher-rated externalizing behavior at both T1 and T2. For parent reported behavior, child affective self-regulation was not related to both externalizing behavior and social competence at T1 and T2. No correlations between center emotional and behavioral support and any of the outcome variables were significant.

3.1. Null Models

First, we specified two Null Models to estimate the amount of variance at both the child and center level. For the teacher-rated behavior it appeared that there was substantial variance that could be attributed to the center level (i.e., level 2) for most outcome variables (Table 4). However, for the parent-rated behavior it appeared that there was little variance that could be attributed to the center level (i.e., level 2) for all outcome variables, which is also reflected in the low Intra-Class Correlations (Table 5). In other words, children in the same child care center were (almost) no more similar to each other than they were to children in other centers on parent-rated outcomes at both T1 and T2. Absence of substantial variance at the center level (i.e., level 2) makes it less likely that there will be a significant main effect of center emotional and behavioral support (a level 2 predictor). However, to investigate cross-level interactions between center emotional and behavioral and child affective self-regulation skills and gender (i.e., effects for subgroups of children), the criterion that there needs to be

Table 6
Full Model. Predicting teacher-rated externalizing behavior and social competence at time 1 (T1) and time (T2).

	Externalizing T1		Social competence T1		Externalizing T2		Social competence T2	
	B	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Level 1—child								
Intercept	1.64***	.46	3.21***	.34	2.06***	.52	3.46***	.43
Externalizing T1	–		–		0.33***	.06	–	
Social Comp. T1	–		–		–		0.23**	.07
Age	0.08	.20	0.21*	.09	−0.08	.19	−0.07	.14
High family education	−0.19	.11	0.04	.07	−0.23**	.08	0.04	.08
Low family education	0.19	.18	−0.01	.14	−0.05	.15	0.01	.11
Ethnic minority status	−0.23	.12	0.04	.07	−0.00	.13	−0.08	.10
Enrollment age 1	0.13	.11	0.19**	.07	−0.03	.09	0.02	.08
Child care quantity T1	0.10***	.02	0.01	.01	0.06**	.02	0.02	.08
Gender (girl)	−0.24**	.07	0.21***	.03	−0.15**	.05	0.12*	.05
Affective self-regulation T1	−0.23**	.08	0.09	.06	−0.09	.08	−0.00	.06
Level 2—Center								
Emotional and behavioral support T1	−0.00	.07	−0.03	.04	0.01	.06	0.08	.05
Comparison variance components								
Level 2 (Null/Full)	.029/.011		.025/.012		.048/.025		.022/.011	
Level 1 (Null/Full)	.512/.440		.188/.172		.445/.339		.220/.207	

Note: $N = 545$ from 59 centers. *B* = unstandardized regression coefficient; *SE* = standard error of *B*. – = not included within model.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

variance at the second level is less important, especially with a relatively small average cluster size[2]. Therefore, we continued with the subsequent steps of the multilevel analysis for both the model with the teacher-rated outcomes and the model with the parent-rated outcomes.

3.2. Full Models

Second, the two Null Models were expanded with the covariates, child outcomes at T1, child affective self-regulation at T1, and gender as child level (i.e., level 1) explanatory variables, and with emotional and behavioral support as the center level (i.e., level 2) explanatory variable. The parameter estimates for the Full Models are given in Table 6 for the teacher-rated outcomes and in Table 7 for the parent-rated outcomes. Congruent with the correlations, there was moderate stability from T1 to T2 for the outcome measures in both models. In addition, there were some main effects of child affective self-regulation and gender (i.e., the main child-level predictors). Table 6 shows that child affective self-regulation at T1 was negatively related to teacher-rated externalizing behavior at T1, and boys showed more teacher-rated externalizing behavior and less social competence at both T1 and T2. In the model with parent-rated outcomes (Table 7), boys showed more externalizing behavior at both T1 and T2. Center emotional and behavioral support was not related to any of the outcome variables in both models.

3.3. Slopes as outcomes models

Finally, to investigate whether the relation between both child affective self-regulation and gender with child socio-emotional outcomes was moderated by center emotional and behavioral support, the models were expanded with two cross-level interactions (i.e., one for child gender and one for child affective self-regulation) for each outcome variable. In the resulting Slopes as Outcomes Model for the teacher-rated outcomes, two cross-level interactions appeared to be significant. The level of center emotional and behavioral support (level 2) influenced the association between child gender and child social competence at T2 (level 1) ($B = -0.20$, $p < .001$), and between child affective self-regulation and child social competence at T2 (level 1) ($B = -0.16$, $p = .019$)[3]. To improve model fit, we removed the non-significant cross-level interactions from the model. The parameter estimates of this final model are presented in Table 8. Finally, we compared the AIC of this model with a model in which only random slopes for child affective self-regulation and gender on teacher-rated social competence at T2 were specified. Including the cross-level interactions decreased the AIC from 4734 to 4727. This AIC is also lower than the AIC of the Full Model without random slopes and cross-level interactions, which was 4730. Moreover, because the Slopes as Outcomes Model is more informative than the Full Model, we decided that this model was the final model

[2] If center emotional and behavioral support only has an effect on children scoring low on affective self-regulation (which could be only one or two children per center), than children in the same child care center are not necessarily more similar to each other than they are to children in other centers (i.e., level 2 variance).
[3] It could be hypothesized that these associations are driven by other characteristics of the center, such as the provided level of *engaged support for learning*. However, including this more instructional domain of the CLASS-Toddler as a covariate in the model did not change the results.

Table 7
Full Model. Predicting parent-rated externalizing behavior at time 1 (T1) and time (T2).

	Externalizing T1		Externalizing T2	
	B	*SE*	*B*	*SE*
Level 1—Child				
Intercept	2.21***	.42	3.24***	.32
Externalizing T1	–		0.40***	.06
Age	−0.03	.16	−0.36**	.13
High family education	−0.07	−.07	−0.15*	.07
Low family education	0.20	.20	0.00	.17
Ethnic minority status	−0.47***	.10	0.35**	.12
Enrollment age 1	0.00	.09	−0.00	.07
Child care quantity T1	0.03		0.00	.02
Gender (girl)	−0.18**	.06	−0.15**	.05
Affective self-regulation T1	0.02	.08	−0.04	.06
Level 2—Center				
Emotional and behavioral support T1	−0.03	.04	0.02	.05
Comparison variance components				
Level 2 (Null/Full)	.003/.002		.010/.006	
Level 1 (Null/Full)	.357/.328		.236/.159	

Note: $N = 392$ from 60 centers. *B* = unstandardized regression coefficient; *SE* = standard error of *B*. – = not included within model.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 8
Slopes as Outcomes model. Predicting teacher-rated externalizing behavior, and social competence at time 1 (T1) and time (T2).

	Externalizing T1		Social competence T1		Externalizing T2		Social competence T2	
	B	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Level 1—child								
Gender (girl)	−0.24**	.07	0.21***	.03	−0.15**	.05	0.12**	.04
Affective self-regulation T1	−0.22**	.08	0.09	.06	−0.09	.08	−0.00	.06
Level 2—center								
Emotional and behavioral support (EBS) T1	−0.01	.07	−0.03	.05	0.01	.06	0.17**	.06
Slope gender|EBS	–		–		–		−0.20***	.06
Slope aff. self.|EBS	–		–		–		−0.16*	.07
Comparison variance components								
Slope gender (Random/Outcome)							.004/.000[a]	
Slope aff. self. (Random/Outcome)							.020/.007	
Level 2 (Null/Outcome)	.029/.012		.025/.013		.048/.025		.022/.012	
Level 1 (Null/Outcome)	.512/.440		.188/.173		.445/.337		.220/.197	

Note: The same covariates were included (see Table 6), and the regression coefficients were practically the same. $N = 545$ from 59 centers. *B* = unstandardized regression coefficient; *SE* = standard error of *B*. – = not included within model.
[a] Little variance around the slope in the Random Slopes Model only means that the data do not provide enough information for distinguishing fixed (true) from random variation, which is plausible given our relatively small cluster size (1 to 18) and small sample size at the cluster level (59). These circumstances make it hard to find *within cluster* (i.e., center) differences in the slopes. However, including a level-2 predictor as a predictor of a random slope adds information, which may provide a foundation for modeling variability in a coefficient through a cross-level interaction (Nezlek, 2012).
* $p < .05$.
** $p < .01$.
*** $p < .001$.

for the teacher-rated outcomes. In the Slopes as Outcomes Model for the parent-rated outcomes, none of the cross-level interactions appeared to be significant. Therefore, we decided that the Full Model was the final model for the parent-rated outcomes.

3.4. Interpretation of cross-level interactions

In order to interpret the significant cross-level interaction between child gender and center emotional and behavioral support, we calculated simple slopes for boys and girls separately (Fig. 1). For boys, there was a significant positive association between center emotional and behavioral support and child social competence at T2 ($B = 0.17$, $p < .001$), above the stability of social competence. For girls, however, there was no significant association between center emotional and behavioral support and social competence at T2 ($B = -0.03$, $p = .621$). In addition, Fig. 1 shows that boys have the lowest levels of social competence when they experience relatively low levels of center emotional and behavioral support. A region of significance

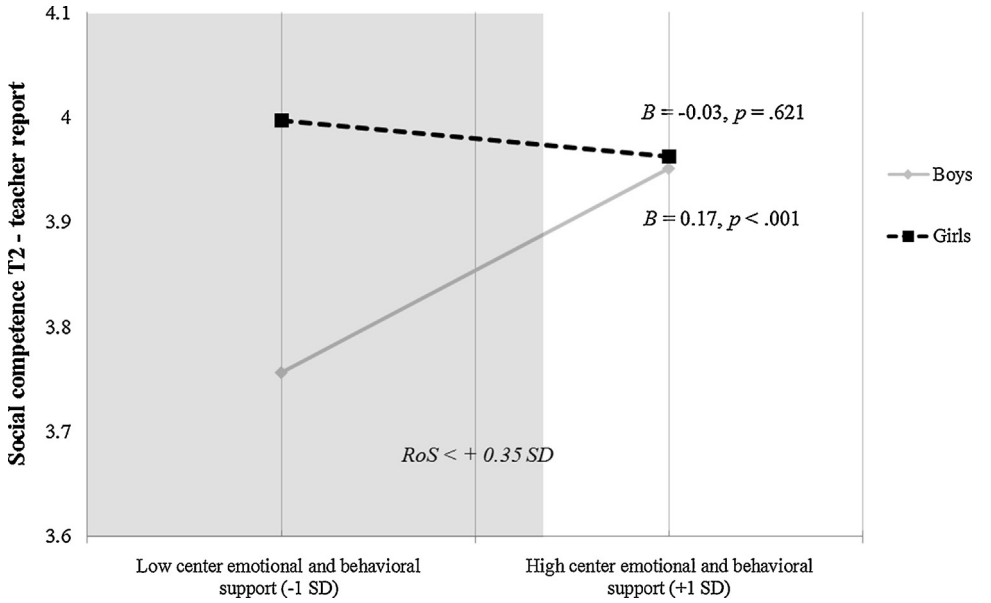

Fig. 1. Cross-level interaction between child gender and center emotional and behavioral support at T1 on teacher-rated social competence at T2, including Regions of Significance (RoS; shaded areas) and unstandardized regression coefficients of the simple slopes (*B*).

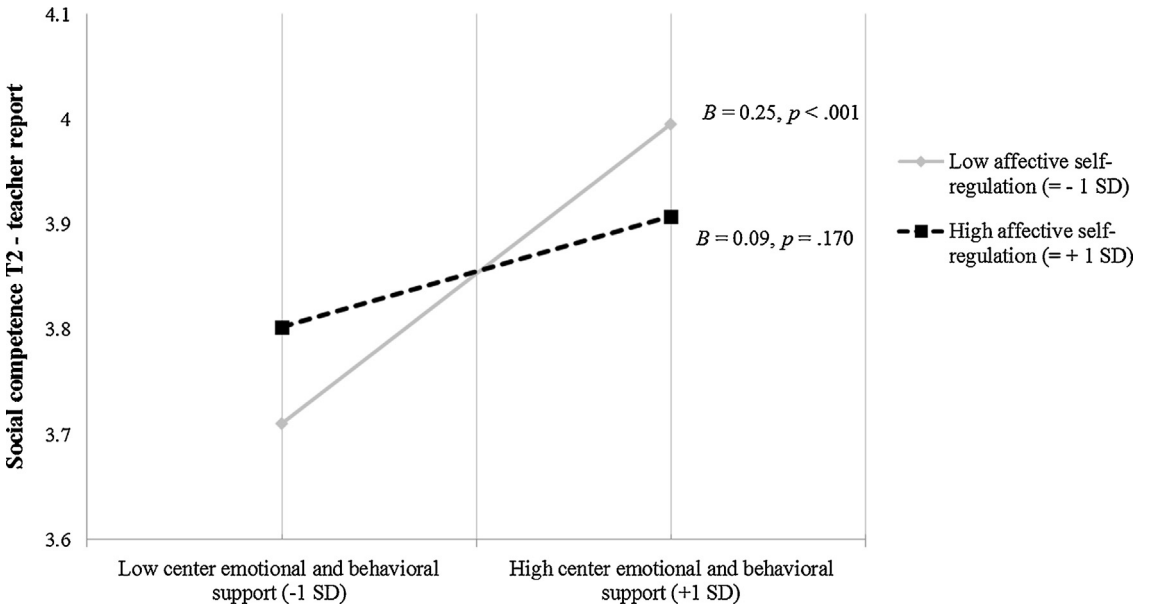

Fig. 2. Cross-level interaction between child affective self-regulation and center emotional and behavioral support at T1 on teacher-rated social competence at T2, including the unstandardized regression coefficients of the simple slopes (*B*). The Regions of Significance for center emotional and behavioral support are <−1.40 *SD* and >1.44 *SD*. These regions fall outside the plotted area.

analysis (Preacher, Curran, & Bauer, 2006) indicated that being a boy was associated with less social competence at T2 at levels of center emotional and behavioral support <0.35 *SD* (i.e., a score below 5.21 on a 1–7 scale, the shaded area in Fig. 1).

For the cross-level interaction between child affective self-regulation and center emotional and behavioral support, simple slopes were calculated at minus and plus one *SD* from the sample mean of child affective self-regulation (±0.50) (Cohen et al., 2003), see Fig. 2. The simple slopes show that there was a significant positive association between center emotional and behavioral support and child social competence at T2 for children scoring relatively low on affective self-regulation ($B = 0.25$, $p < .001$). This means that a one-point increase in center emotional and behavioral support was related to a 0.25 increase in teacher-rated social competence at T2 for children low in affective self-regulation, above the stability of social

competence. For children relatively high on affective self-regulation, however, there was no significant association between center emotional and behavioral support and child social competence at T2 ($B = 0.09$, $p = .170$). In addition, Fig. 2 shows that children low on affective self-regulation have the *lowest* levels of social competence when they experience low levels of center emotional and behavioral support and the *highest* levels of social competence when they experience high levels of center emotional and behavioral support. A region of significance analysis indicated that child low affective self-regulation negatively predicted child social competence at T2 at levels of center emotional and behavioral support <1.40 *SD* below the sample mean (score <4.20) and positively predicted child social competence at T2 at levels of center emotional and behavioral support >1.44 *SD* above the sample mean (score >5.84). These regions are outside the plotted area in Fig. 2.

4. Discussion

The current study used a sample of Dutch children in center-based child care to investigate whether high process quality child care, measured as the level of center emotional and behavioral support, interacts with children's affective self-regulation abilities and gender in relation to teacher and parent reports of children's externalizing behavior and social competence one year later (age 3). By examining the moderating effect of children's affective self-regulation skills and gender simultaneously, it was possible to test whether affective self-regulatory abilities and gender were unique moderators of child care quality effects, or whether the moderating effect of gender could (partly) be explained by the on average lower levels of affective self-regulation of boys.

Contrary to our hypotheses, center emotional and behavioral support did not predict teacher-rated or parent-rated externalizing behaviors one year later, and we found no evidence for moderation by child affective self-regulation and gender. However, we did find that center emotional and behavioral support was positively related to teacher-rated social competence for children having lower affective self-regulatory abilities *and* for boys. That is, both the interaction effect of child gender and affective self-regulation skills with center emotional and behavioral support were significant when included simultaneously within the model. This means that the stronger association between center emotional and behavioral support and child social competence for boys could not be explained by their on average lower self-regulatory abilities.

An alternative explanation for the specifically detrimental effects of low quality child care for boys' social competence, which is outlined by Votruba-Drzal et al. (2010, 2004), is related to differences between boys' and girls' play behaviors and social interactions. Several studies have shown that boys tend to engage in more physical, rough and (sometimes) aggressive play, whereas girls' play is more focused on cooperation and communication (Fabes, Hanish, & Martin, 2003). In the child care setting, children spend a considerable amount of time in free play situations. It might be that boys' more physical and less structured type of play during those free play moments accounts for the stronger detrimental effects (i.e., less social competence) of low quality, less-structured child care experiences, rather than lower self-regulatory abilities of boys. On the other hand, when boys are provided with high quality, well-structured child care environments with more sensitive and responsive caregivers, they may show the same level of social competence as girls in the child care, and specifically in free play settings. This explanation, however, warrants future investigation.

Besides the fact that children with low affective self-regulatory skills exhibit less social competence when center emotional and behavioral support is low, the results also indicated that these children show more social competence if center emotional and behavioral support is high. These stronger effects of both low and high child care quality replicate findings on child care process quality by reactive temperament interactions (Phillips et al., 2012; Pluess & Belsky, 2009), and are in line with the differential susceptibility hypothesis, in which children with certain temperamental dispositions are, in general, more susceptible to their environment, both for better and for worse (e.g., Belsky, 1997; Belsky et al., 2007). One earlier mentioned plausible mechanism for these stronger associations, is that children with low affective self-regulation skills rely more heavily on the external regulation of their behaviors by their caregivers. That is, they are more open to both negative *and* positive socialization influences compared to children with average or high levels of self-regulation. This openness to external regulation leads to stronger negative effects in the case of low quality child care and to stronger positive effects in the case of high quality child care. However, as this is the first evidence for child affective self-regulation skills as a differential susceptibility factor, replication of this finding is needed.

4.1. Limitations of the present study

There are a few remarks about the results, design, and sample that need to be mentioned. First, unlike other studies (Mashburn et al., 2008; NICHD ECCRN, 2006), we found no main effect of center emotional and behavioral support on both teacher- and parent-reports of children's externalizing behaviors. These results are in line with the recent meta-analytic study by Keys et al. (2013) that showed that child care and preschool process quality were not consistently associated with teacher reports of children's socio-emotional development one year later. However, another feasible explanation is that children in the Netherlands do not spend enough time in care (i.e., on average only two to three days; Veen et al., 2010) for effects on externalizing behavior to occur. This is consistent with studies that showed that child care quality effects on children's behavior problems were stronger when children spent more time in high quality child care (Burchinal et al., 2008; Votruba-Drzal et al., 2004).

A second and related issue in this study is that the significant main and interaction effects were all small in size. A possible explanation for these small effects is that the variability in our classroom quality measure was relatively low, with almost

all centers scoring moderate to high on center emotional and behavioral support. In addition, 50% of the children reached the highest score on the separate delay of gratification tasks. This restricted variance makes it more difficult to find strong effects of center emotional and behavioral support on children's socio-emotional development, and this issue is amplified when investigating interaction effects (McClelland & Judd, 1993; Whisman & McClelland, 2005). However, the fact that we still found effects, even with predominantly moderate to high quality levels, stresses the significance of emotionally and behaviorally supportive child care. In addition, early child care is becoming a normative experience for children in many western countries (Lamb & Ahnert, 2006). Although perhaps small on an individual level, both positive and negative effects for society can be large when many children are influenced.

A final remark concerns the relatively high non-response rate by teachers and parents, which raises the possibility that only the most committed teachers and parents participated in the study. However, there were no initial differences in affective self-regulation skills and socio-emotional adjustment between children whose parents or teachers participated at T2 compared to those who did not, suggesting that selection bias was not a problem. Moreover, the examination of both age 2 and age 3 outcomes within the same model using a FIML procedure compensates (at least partially) for possible unidentified selection effects (Enders, 2010).

4.2. Conclusion

The current study makes several contributions to the field of early child care research. As mentioned before, to our knowledge, this study is the first to investigate whether specifically child affective self-regulation skills, as an indicator of the regulatory dimension of child temperament, moderates the relation between child care process quality and children's social competence and externalizing behavior one year later at age 3. Moreover, we assessed child affective self-regulation through delay of gratification tasks, instead of using parent or teacher ratings of child temperament. In this way we have tried to assess the actual regulatory abilities of the child, instead of the perception of children's regulatory abilities. In addition, by simultaneously including interactions between child gender and center emotional and behavioral support in the model, this study was the first to test whether the often reported stronger detrimental effects of low quality child care for boys could be explained by their on average lower self-regulatory abilities. However, as mentioned above, both child gender and affective self-regulation appear to be unique moderators of child care quality, which counteracts or at least weakens this often speculated mechanism.

A final contribution of the current study is the use of a large Dutch sample, extending the knowledge base on the impact of center-based child care quality which has been primarily conducted in the U.S. Cross-cultural research shows that child-drearing belief systems and resulting caregiving practices can differ greatly between Western cultures (e.g., Harkness, Super, & van Tijen, 2000; Super et al., 1996). For example, Super et al. (1996) found that the importance of quiet time for children was more heavily stressed by Dutch than U.S. parents. In combination with more structural differences in the organization of center-based child care, such as high variation in the amount of days that children attend child care centers, it is clear that results from the U.S. cannot directly be generalized to other countries (Love et al., 2003; Vermeer et al., 2008).

In conclusion, this study stresses the importance of considering child characteristics such as child affective self-regulation and gender in understanding the effects of child care quality in relation to children's social competence. When studies focus on main effects of child care quality without considering individual differences, important associations between child care quality and child socio-emotional development might be overlooked. This study shows that high process quality child care can improve children's social competence, specifically for boys and children who have lower affective self-regulation skills. Intervention strategies and policies can benefit from this knowledge by supporting and stimulating high process quality child care and by creating awareness among early child care practitioners that an emotionally and behaviorally supportive classroom climate might be even more important for boys and children with low affective self-regulation skills. When child care centers fail to provide high quality child care, an important opportunity for stimulating these children's social development will be lost.

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