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Children's executive and social functioning and family context as predictors of preschool vocabulary

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ABSTRACT

The primary source for young children's vocabulary development is parent-child interaction. How parent-child interaction influences vocabulary depends on the child's functioning and the family context. Although research shows the effect of the family context on vocabulary (e.g., reading activities at home, parental education), the role of a child's functioning has received less attention. Children's executive functioning (EF) influences how linguistic input is processed and their social functioning (SF) is important for maintaining social interaction. The aim of the present study was to investigate the additional contributions of children's EF and SF to vocabulary. EF, SF and family contextual factors were measured in 223 Dutch preschool children. EF and SF strongly predicted children's vocabulary in addition to their age, linguistic diversity at home and parental education. EF and SF are therefore important factors to take into account when investigating vocabulary and vocabulary interventions in preschool children.

1. Introduction

Children's vocabulary development is an informal learning process that takes place through interactions with adults (Leseman & De Jong, 1998). Considering the large amount of time a preschool child spends at home, their primary source for language input and practice is verbal parent-child interaction (Snow, 2006). Parent-child interaction differentially affects a child's vocabulary depending on child functioning and of the family context in which it occurs (Bronfenbrenner & Morris, 1998). Even though the influence of the family context on preschool vocabulary has been well established, less attention has been given to how child functioning influences vocabulary development. The family context, including educational level and linguistic diversity has been found to have a great impact on vocabulary development (e.g., Ebert et al., 2013; Hoff, 2006; Van Druten-Frietman, Denessen, Gijsel, & Verhoeven, 2015).

Moreover, there is growing evidence that a child's executive functioning (EF; the ability to control and regulate cognitive and behavioral processes) and social functioning (SF; successful initiation of interactions and relationships) play an important role in how that child acquires vocabulary from parent-child interaction (Diamond, 2006; McClelland, Morisson, & Holmes, 2000). Nevertheless, few studies have examined vocabulary while including a child's EF and SF in addition to the family context (Vitiello & Williford, 2016; Weiland, Barata, & Yoshikawa, 2014). Up until now vocabulary has mainly been studied from the perspective of the family or the child, but only limited attention has been paid to the integration of EF, SF and the family context (Ebert et al., 2013; Van Druten-Frietman et al., 2015). In the present study, we therefore addressed the role of EF and SF in predicting preschool children's vocabulary in addition to the family context. Identification of how children's EF and SF at an early age contribute to vocabulary could provide insights into improving intervention programs that aim to facilitate children's vocabulary at home.

1.1. Vocabulary in the family context

From a social constructivist perspective, vocabulary development is, fundamentally, a social process that takes place via verbal interactions with others (Leseman & de Jong, 1998). Therefore, several aspects of the family context are important for a preschool child's vocabulary. In the first place, a child must be offered opportunities to participate in language stimulating activities, such as shared book reading or singing songs and rhymes (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004). The frequency with which a child is involved in these types of activities at home is correlated with their vocabulary (Bus, Van IJzendoorn, & Pellegrini, 1995). In general, lower

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educated parents engage in fewer reading activities with their child (Hoff, 2006; Scarborough & Dobrich, 1994), which is related to the degree of their self-efficacy (parent's beliefs about their capacities to control their functioning and environmental demands (Bandura, 1986). Parents with a lower level of education often feel themselves less proficient in influencing their child's development and behavior (Bandura, 1986; Seefeldt, Denton, Galper, & Younoszai, 1999) and are therefore less likely to be involved with their child than more highly educated parents who often believe their involvement will make a difference (Walker, Wilkins, Dallaire, Sandler, & Hoover-Dempsey, 2005).

Secondly, acquiring vocabulary from these home activities is facilitated by other more experienced adults who, in case of preschool children, are often the parents (Rogoff, 1990). The quality of verbal interaction between a parent and child plays an especially important role in vocabulary development (Rowe, 2012). Often, lower educated parents have lesser language skills, using more concrete language about the here and now and less abstract language about what is beyond perceptual presence (Van Kleeck, Gillam, Hamilton, & McGrath, 1997). Moreover, children growing up in linguistically diverse families, with a minority language spoken at home, receive less language input in the native language of the country that they are growing up in and therefore experience fewer opportunities to practice this language (Scheele, Leseman, & Mayo, 2010; Van Druten-Frietman et al., 2015). Even though children's prior language experiences (L1) are beneficial for learning a second language (L2) (Cummins, 1979), L2 children tend to have smaller vocabularies in L2 compared to their peers for whom that language is L1 (Mancilla-Martinez & Vagh, 2013). As a result, children from lower educated parents with limited self-efficacy and children speaking a minority language at home often have smaller vocabularies and develop vocabulary at a slower rate (Hart & Risley, 1995; Hoff, 2006; Seefeldt et al., 1999).

Even though, the influence of the family context on vocabulary has been well established over the past decades (Ebert et al., 2013; Hart & Risley, 1995; Hoff, 2006; Van Druten-Frietman et al., 2015), less attention has been paid to the child's functioning and how this influences parent-child interactions and vocabulary. Often age and gender are included in analyses, with older children showing greater vocabularies and little or no difference between preschool girls and boys (Ebert et al., 2013; Van Druten-Frietman et al., 2015). Along with age and gender, vocabulary is considered to be influenced by a child's functioning, that is to say their executive and social functioning (Diamond, 2006; McClelland et al., 2000). These abilities allow a child to control and regulate the verbal input provided and are considered to be essential for participation in social situations.

1.2. Executive functioning and vocabulary

Vocabulary acquisition in young children via social interactions seems to depend on their executive functioning (EF). EF is defined as their ability to control and regulate their cognitive and behavioral processes (Lezak, 1995; Mesulam, 2002). EF can be viewed as a multidimensional concept involving the interrelated components of working memory, response inhibition and attention shifting (Diamond, 2013; Miyake et al., 2000). Working memory is the ability to hold information in mind and allows the information to be retained for learning (Gathercole & Baddeley, 1993). Response inhibition is the ability to suppress prepotent responses and allows children to control and suppress automatic, impulsive behaviors and to carry out less automatic responses in their place (Diamond, Kirkham, & Amso, 2002; Weiland et al., 2014). Attention shifting refers to children's ability to flexibly shift to a new situation or another mind set (Garon, Bryson, & Smith, 2008). These skills start developing around the age of one and improve substantially during the preschool years (Welsh, Nix, Blair, Bierman, & Nelson, 2010). It is now widely acknowledged that, in three-year-old preschool children, the different EF components form a unitary construct (Barata, 2011; Fuhs & Day, 2011; Wiebe, Espy, & Charak, 2008; Wiebe et al., 2011). When children become older, the separate components become more clearly differentiated and develop into distinct mental abilities (Miyake et al., 2000; Tucker-Drob, 2009). As EF is a unitary construct formed by multiple components, a multiple task approach is desirable to achieve a reliable EF score in preschool children (Wiebe et al., 2011).

Empirical studies have shown that EF in preschool children supports the development of vocabulary (McClelland et al., 2000; Weiland et al., 2014). Children with greater EF skills in preschool had larger vocabularies in preschool and elementary school. EF seems to be essential for children's initial language development. It helps them to focus on and process multiple streams of language input at the same time, monitor errors, and make decisions based on the available linguistic information (Diamond, 2013). In order to abstract meaning from social interaction, children use shifting, inhibition and memory abilities at the same time. For example, they shift attention between contexts to derive word meanings corresponding to a particular context, they focus on the relevant linguistic input by suppressing attention to irrelevant and distracting input, and they hold phonological representations of words in mind and store them in their long-term memories (Bialystok, Barac, Blaye, & Poulin-Dubois, 2010; Moriguchi, 2014; Weiland et al., 2014). Moreover, EF facilitates social interactions because it helps children to overcome saying the first thing that comes into their head (Moriguchi, 2014). Controlling and regulating their behavior in social interactions allows children to obtain the linguistic input that they require in order to expand their vocabulary. Recent research has shown the contribution of EF to children's communicative behavior and vocabulary (Moriguchi, 2014; Weiland et al., 2014). However, the (relative) contribution of EF to vocabulary is still unclear because it has not been considered in conjunction with children's social functioning and in relation to the family context.

1.3. Social functioning and vocabulary

Along with EF social functioning is considered necessary for the word learning process. Children's social functioning (SF) enables them to initiate, participate in and maintain interaction with their parents, other adults and peers, which is essential for generating language input and to practice language (McClelland et al., 2000; Vitiello & Williford, 2016). SF includes, for example, pro-social behavior in which children interact positively, play collaboratively and share and take care of others. SF is especially important in understanding the reciprocal nature of interactions and the integration of input from parents and children into a coherent social event (Feldman, Bamberger, & Kanat-Maymon, 2013). Reciprocity changes over the course of the preschool years with a gradual shift from greater amounts of parental reciprocity, with the parent adapting to the child, to a more balanced giving and receiving. Gradually, the child develops an understanding of the reciprocity of communication, including their own contribution. SF forms the basis for the quality and quantity of child-parent interaction. Children with higher levels of SF engage in more conversations with adults and peers (McClelland et al., 2000). Studies have also shown that stronger SF at preschool relates to better learning and greater gains in vocabulary (Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000; Vitiello & Williford, 2016; Ziv, 2013). However, the relative importance of SF needs further study to establish its role in vocabulary in conjunction with EF and taking into account the family context.

1.4. This study

The aim of this study was to examine the role of the children's EF and SF in predicting preschool vocabulary in addition to the family context. The influence of the family context on preschool vocabulary has been well established with the parents' educational level, their self-efficacy, and the language spoken at home being important (Ebert et al.,

2013; Hoff, 2006; Van Druten-Frietman et al., 2015). However, the supplementary role of child functioning has received little attention to date. After a child's age and gender, their EF and SF are expected to play an important role in vocabulary (Diamond, 2006, 2013; Weiland et al., 2014). EF is assumed to contribute to the processing of linguistic input and SF to being able to uphold social interaction. Despite the perceived importance of EF and SF as stressed in recent theories, few studies have addressed their contribution to preschool vocabulary and, those that have, paid limited attention to the family context (Weiland et al., 2014). Vocabulary has mainly been studied from the perspective of the family or the child without a clear focus on the integration of EF and SF (Ebert et al., 2013; Van Druten-Frietman et al., 2015). Therefore, we investigated the extent to which EF and SF predict preschool vocabulary, while taking into account children's age and gender and family contextual factors linguistic diversity, parent education, reading activities at home and parent self-efficacy.

First of all we expected to confirm the contribution of the family context to vocabulary (Ebert et al., 2013; Hoff, 2006; Van Druten-Frietman et al., 2015). In addition to the family context we hypothesized a contribution of both EF and SF to vocabulary. Children with better abilities to control and regulate their behavior were expected to have larger vocabularies (Moriguchi, 2014; Weiland et al., 2014). Furthermore, children who are engaged in more interactions may have more opportunities to increase their vocabulary (McClelland et al., 2000; Vitiello & Williford, 2016).

2. Method

2.1. Participants

The present study is part of the longitudinal project Parents in Preschool Education in the Netherlands. For this project, we approached Dutch preschool organizations, of which four agreed to participate with a total of 13 preschools (two to six per organization). All preschools met Dutch policy quality standards for preschool education (i.e., a maximum class size of 16 children, child-to-teacher ratio of 16:2, a certified Early Childhood Education (ECE) program and preschool teachers who received specialized ECE training). Preschools were located throughout the Western provinces of The Netherlands. Each participating preschool had, on average, 17 children, ranging from eight to 30.

In the Netherlands, preschool is available for children at the age of 2 to 4. Children were selected based on their age (2;6 to 3;3 years of age), resulting in a total of 223 preschool children (M_{age} = 35.4 months, SD = 3.5) of which 43.5% (n = 97) were girls. At the time of testing, children had been attending preschool on average for 7.5 months (SD = 4.5 months, range: 0–15). Children were linguistically diverse and learned Dutch either as a first (L1) or second (L2) language. Children were defined as first language learners when only Dutch was spoken at home. When another other language was spoken at home, either by one or both parents, they were indicated as second language learners. The sample consisted of 108 L1 children (48.4%) and 115 L2 children. There was quite some variety in the L2 leaners' first language, with a total of 48 different languages and Moroccan, Turkish and Polish occurring most frequently. The ratio of L1/L2 children within preschools varied from 20.0% to 94.4% L2 children.

Highest education of the mother was used as a measure for educational level, based on maternal education being the most robust sociodemographic predictor of infant behavior. Especially at this young age, mothers exert the greatest influence on children's development (Bornstein, Hahn, Suwalsky, & Haynes, 2003). Educational level was measured on a six-point-scale ranging from no education (1) to university (6) and showed a mean of 4.4 (SD = 1.2). There was a small bias, as for one preschool (n = 18), the percentage of lower educated mothers was fairly high (33.3%), whereas for three other preschools (n = 18 to 25) the percentage of higher educated mothers was high (60% to 76.2%).

2.2. Measures

2.2.1. Vocabulary

The outcome measure of our study was the Dutch receptive Peabody Picture Vocabulary Test (Dunn & Dunn, 2005). In this task, the child was orally presented one target word at a time. Out of four pictures he/she had to select the picture corresponding to the target word. The test was finished when the child gave nine or more incorrect responses within a set of 12 items. Each item was scored as one point, with a maximum of 175 points.

2.2.2. Executive functioning (EF)

In line with previous research into preschool children's EF (Wiebe et al., 2011; Weiland et al., 2014), the EF concept was operationalized with multiple tasks measuring different dimensions that cluster into a unitary EF construct. Each task relied on a different but related EF component. Scores on the three components together formed a composite EF score (see Analysis).

In the *working memory* task, children had to repeat strings of common, Dutch one syllable words in the same order, starting with a one word-string until a maximum of a six word-string (Schlichting & Lutje Spelberg, 2010). The test was stopped after two consecutive mistakes. With one point for each correctly repeated word string, the maximum score was 13 points. Internal consistency was sufficient (Cronbach's α = 0.81).

Response inhibition was measured by the Hand Game (Hughes, 1996). After an imitation phase during which children had to imitate six hand gestures (fist or flat hand) of the experimenter, the test phase started. At least five out of six imitation phase trials had to be correct in order to continue to the test phase. In the test phase, children had to make 15 hand gestures opposite to the experimenter's hand gesture (also fist or flat hand) and inhibit the pre-potent imitation response. Following the test and scoring protocol (Hughes, 1996), children passed this test (score of one) when they made a series of six correct responses within the 15 trials, and failed (zero-score) if they did not make a series of six correct responses. Internal consistency of the task was high (Cronbach's α = 0.90).

Attention shifting was measured by the Dimension Change Card Sort (DCCS, Zelazo, 2006). Children were shown cards representing colored shapes (stars or cars) that could be sorted according to color or shape. In the pre-switch phase, children had to sort six cards according to one dimension (shape or color). Children needed to sort at least 5 out of six cards correctly to continue to the switch phase. In the switch phase, children had to shift to another mental set and sort the cards according to the other dimension (color or shape). Following the test and scoring protocol (Zelazo, 2006), a zero-score was assigned if children failed the switch phase (< 5 cards sorted correctly) and a score of one was assigned if they passed the switch phase. Internal consistency of the task was sufficient (Cronbach's α = 0.73).

2.2.3. Social functioning (SF)

Children's SF was measured by the Dutch KIJK! observation scale for preschool children (Van den Bosch & Duvekot-Bimmel, 2012) that was completed by their preschool teacher. The observation scale consisted of fifteen statements on how children behave with respect to peers and teachers (for example, 'the child is able to share with other children'). Items were scored on a 3-point-scale including 'not true', 'partly true' and 'entirely true'. Internal consistency was high (Cronbach's α = 0.90) which is in line with the validated kindergarten version (Van den Bosch & De Jaeger, 2000).

2.2.4. The family context

Three questionnaires were administered to families. Questionnaires were filled out by one of the parents, in most cases the mother (86.1%).

Questionnaires were available in Dutch and English. If parents had questions they were helped by translating or explaining unknown words.

The *demographic information* questionnaire contained questions about the parents' educational level, the language(s) spoken at home (to determine linguistic diversity, whether Dutch was the child's L1 or L2) and the child's gender and date of birth.

The frequency of *reading activities at home* was identified by a parent self-reported questionnaire, based on the questionnaire of Griffin and Morrison (1997). The reading activities questionnaire used in the current study (see Appendix A) consisted of eight items in total asking about the parent's reading activities (for example: 'How often do you read a book?') and the child's reading and educational activities (for example: 'How often does your child play educational games, such as memory and puzzles?'). Items were scored on a 3-point-scale; 'never', 'sometimes' and 'often'. After deleting one item because of low reliability ('How often does your child play digital educational games?'), Cronbach's α was 0.60. The mean score of the seven remaining items was the final score.

Parent self-efficacy was measured by an adapted version of the Parent Self-Efficacy Questionnaire (Walker et al., 2005) filled out by the parent. After translation into Dutch, the questionnaire was simplified (shorter sentences with easier vocabulary) to make it understandable for lower educated parents and parents with limited Dutch language proficiency. Parent self-efficacy (see Appendix B) consisted of seven items and contained questions on parent's nurturing feelings such as 'I know how to help my child when they have to learn new things'. Items were scored on a 3-point-scale consisting of 'no', 'a little' and 'yes'. After deletion of one item ('I am more influential for my child than the preschool teachers'), Cronbach's α was 0.54 and item-total correlations were above $r = 0.20$, indicating that items were measuring the same construct.

2.3. Procedure

The first period of data collection was in autumn 2015, when the majority of children had just entered preschool. Children were individually tested in a quiet place outside the classroom by test-assistants. Eight test-assistants were trained and followed strict testing protocols. Testing took place within two separate sessions. After an instruction phase, children completed the vocabulary and EF tasks. Even though test-assistants first spent some time with the children in the classroom to familiarize themselves with the children, some children were distressed during test-administration and started to cry or refused to participate. This resulted in failure to administer the test. At the time of testing, parents and teachers completed the questionnaires. All parents gave active consent for their child's and their own participation. The study was approved by the Ethics Committee for Behavioural Research of Radboud University (dossier ECG2013-0606-116).

2.4. Analysis

Preliminary analyses were conducted to ensure no violation of the assumptions of normality and homogeneity of variance. A composite EF score was then calculated with the multiple tasks to measure this unitary construct. Principal Component Analysis with Varimax Rotation showed one underlying factor with an eigenvalue > 1, explaining 42.6% of the total variance. Component loadings were 0.57 (working memory), 0.74 (response inhibition) and 0.64 (attention shifting). The composite score was calculated by adding up the z-score of the working memory task and the dichotomous scores of response inhibition and attention shifting. This was then divided by the number of tasks ((z-memory + response inhibition + attention shifting) / 3).

Subsequently, missing data was analyzed. Of 223 children, one child was absent due to vacation. Failed test administration resulted in missing data at the PPVT (7.2%), working memory (8.1%), complex response inhibition (14.3%), and attention shifting (4.9%). Of 223 distributed SF questionnaires, 201 were returned (90.1%). All demographic information was complete, as these questionnaires were part of the informed consent form that was a prerequisite for participation. Return rate of the questionnaires reading activities at home and parent self-efficacy was 98.2%. A missing value analysis indicated that data were missing completely at random (Little MCAR-test: $\chi^2 = 220.846$, $df = 225$, $p = 0.566$). Therefore, missing data were replaced using the Expectation-Maximization algorithm (Dempster, Laird, & Rubin, 1977) in SPSS 22 (IBM Corp, 2013).

As our goal was to examine the impact of EF and SF while taking into account the child's age and gender and the family context, a hierarchical regression analysis was conducted. In the first model, we entered children's age and gender and family contextual factors (linguistic diversity, education of the mother, reading activities at home and parent self-efficacy) to test their contribution to vocabulary. EF and SF were subsequently included in the second and third step respectively to investigate their additional contributions.

In order to compare the relative contribution of the predictor variables and to facilitate interpretation of the results, both standardized β-values and unstandardized Beta-values were analyzed. As the data has a nested structure with children in preschools, multilevel analysis was applied. A two-level model with preschool and child level had a significantly better fit than a one-level model with child level only ($\Delta - 2LL = 6.791$, $df = 1$, $p = 0.009$). Even though the intra-class correlation was small with $\rho = 0.08$, Kreft and De Leeuw (1998) demonstrated that even small values may inflate the alpha level resulting in an increased chance of a Type I error. All multilevel analyses were carried out using MLwiN version 2.35 (Rasbash, Steele, Browne, & Goldstein, 2009).

3. Results

3.1. Descriptive statistics

Table 1 presents the descriptive statistics for outcome and predictor measures. The response inhibition and shifting tasks had relatively low success rates. On the response inhibition task, only 9% of the children succeeded and on the shifting task, only 14.3% succeeded. Because this was the first data collection period of a longitudinal study and most children were under three years old, it was expected that these skills had not yet developed in the majority of children (Carlson, Moses, & Claxton, 2004; Carlson, 2005; Garon et al., 2008). Table 2 presents bivariate Pearson's correlations between all study variables. All predictor variables significantly related to vocabulary with moderate positive associations, except for the child's gender ($r = 0.09$, $p = 0.165$) and mother's education ($r = 0.12$, $p = 0.071$). Strong

Table 1
Means and standard deviations for outcome and predictor measures ($N = 223$).

		Mean	SD	Min–max
Outcome	Vocabulary	26.6	15.7	1–71
Predictors	Child age in months	35.4	3.5	23–44
	Child gender (girls)	43.5%		0–1
	Family context			
	Linguistic diversity (L2)	51.6%		0–1
	Education mother	4.4	1.2	1–6
	Reading activities at home	2.5	0.3	1–3
	Parent self-efficacy	2.7	0.3	1–3
	Executive functioning	0.1	0.4	− 0.6–1.2
	Working memory	4.1	2.3	0–12
	Response inhibition[a]	9%		0–1
	Attention shifting[a]	14.3%		0–1
	Social functioning	2.4	0.5	1–3

[a] Note: As the inhibition and shifting measures were dichotomous (fail vs. succeed), the percentage of children that succeeded is reported.

Table 2
Bivariate Pearson's correlations between study variables (N = 223).

	1.	2.	3.	4.	5.	6.	7.	8.	9.
Outcome									
1. Vocabulary	1								
Predictors									
2. Child age	0.34**	1							
3. Child gender	0.09	0.03	1						
4. Linguistic diversity[a]	− 0.50**	− 0.09	− 0.07	1					
5. Mother education	0.12	0.06	− 0.14*	0.05	1				
6. Reading activities	0.32**	0.07	0.10	− 0.35**	0.10	1			
7. Parent self-efficacy	0.28**	0.04	− 0.01	− 0.30**	0.05	0.38**	1		
8. Executive functioning	0.56**	0.37**	0.10	− 0.33**	0.03	0.26**	0.20**	1	
9. Social functioning	0.50**	0.26**	0.17**	− 0.32**	− 0.02	0.24**	0.26**	0.53**	1

[a] Reference category is L1.
* $p < 0.05$.
** $p < 0.01$.

associations were found between vocabulary scores and linguistic diversity at home ($r = -0.50$, $p < 0.001$), EF ($r = 0.56$, $p < 0.001$) and SF ($r = 0.50$, $p < 0.001$).

3.2. Executive and social functioning predict preschool vocabulary

Results of the multilevel analysis are presented in Table 3. The first model, including the child's age and gender and the family context, showed that children's age ($\beta = 0.08$, $p < 0.001$), linguistic diversity ($\beta = -0.82$, $p < 0.001$) and mother's educational level ($\beta = 0.10$, $p = 0.028$) significantly predicted children's vocabulary, whereas the child's gender ($\beta = 0.12$, $p = 0.276$), reading activities at home ($\beta = 0.30$, $p = 0.107$) and parent self-efficacy ($\beta = 0.37$, $p = 0.080$) did not. Thus, L1 children had higher vocabulary scores than their L2 peers and older children and children with more highly educated mothers scored higher.

In the second model, EF was added. EF significantly predicted vocabulary ($\beta = 0.90$, $p < 0.001$). Children with higher EF scores had higher vocabulary scores. By including EF in the model, R^2 increased from 0.38 to 0.48. In the third model SF was included. SF significantly predicted vocabulary ($\beta = 0.48$, $p < 0.001$). More social children had higher vocabulary scores. Adding SF to the model accounted for an R^2 increase of 0.02, with a total R^2 of 0.50. In this final model, EF was the strongest predictor of vocabulary ($\beta = 0.67$, $p < 0.001$), followed by linguistic diversity at home ($\beta = -0.62$, $p < 0.001$) and SF ($\beta = 0.48$, $p < 0.001$). As in the previous models, the mother's educational level ($\beta = 0.11$, $p = 0.012$) and children's age ($\beta = 0.04$, $p < 0.01$) were also significantly related to vocabulary, although these relationships were less strong.

4. Discussion

In this study we investigated the role of EF and SF in predicting preschool children's vocabulary over and above the family context. The results support the theory that the impact of parent-child interaction on children's vocabulary depends on child functioning in addition to the family context (Bronfenbrenner & Morris, 1998). Our findings confirm previous studies (Ebert et al., 2013; Hoff, 2006; Van Druten-Frietman et al., 2015) showing the large impact of the family context. Linguistic diversity and mother's education were found to be strong predictors of

Table 3
Multilevel model of vocabulary prediction. Estimates, standard errors and beta values (N = 223) are shown for each model.

	Model 0		Model 1			Model 2			Model 3		
Fixed model	Estimate	SE	Estimate	SE	β	Estimate	SE	β	Estimate	SE	β
Intercept	26.38**	1.60	19.70**	1.50	− 0.44	21.19**	1.39	− 0.35	21.99**	1.45	− 0.29
Predictors											
Child age			1.30**	0.24	0.08	0.76**	0.24	0.05	0.67**	0.23	0.04
Child gender[a]			1.86	1.70	0.12	1.07	1.57	0.07	0.04	1.55	0.00
Family context											
Linguistic diversity[b]			− 12.84**	1.85	− 0.82	− 10.42**	1.74	− 0.66	− 9.82**	1.72	− 0.62
Education mother			1.62*	0.74	0.10	1.53*	0.68	0.10	1.67*	0.66	0.11
Reading activities at home			4.73	2.94	0.30	2.51	2.73	0.16	2.29	2.64	0.15
Parent self-efficacy			5.84	3.30	0.37	4.53	3.04	0.29	2.64	3.00	0.17
Executive functioning						14.10**	2.21	0.90	10.58**	2.34	0.67
Social functioning									7.47**	2.04	0.48
Random model	Variance (SE)		Variance (SE)			Variance (SE)			Variance (SE)		
Preschool level	19.19 (13.00)		3.60 (4.87)			2.81 (4.01)			5.96 (5.11)		
Individual level	227.38 (22.18)**		149.09 (14.53)**			126.30 (12.31)**			117.30 (11.44)**		
Total	246.57		152.69			129.11			123.25		
R^2	–		0.38			0.48			0.50		
− 2 log likelihood	1854.38		1753.31			1715.09			1703.38		
χ^2 difference test			$\chi^2(6) = 101.07$**			$\chi^2(1) = 38.22$**			$\chi^2(1) = 11.709$**		

$R^2 = (\sigma_{\text{null model}} - \sigma_{\text{estimated model}}) / \sigma_{\text{null model}}$.
* $p < 0.05$.
** $p < 0.01$.
[a] Reference category = girl.
[b] Reference category = L1.

children's vocabulary. Secondly, our findings complement and extend previous research as it shows that, a child's EF and SF predict vocabulary over and above family contextual factors. These results show that, when examining associations between EF, SF and early vocabulary, it is important to integrate the child's functioning and the family context.

With regard to the family context, this study confirms previous research showing that linguistic diversity and education of the mother are significant predictors of children's vocabulary (Ebert et al., 2013; Van Druten-Frietman et al., 2015). Linguistic diversity (being a first (L1) or second language learner (L2) of Dutch) was found to have an especially strong impact on vocabulary. The impact of linguistic diversity and educational level on vocabulary can be explained by the amount and quality of language input children are exposed to at home. L2 children often experience less input in the native language of the country that they are growing up in at home, because a certain amount of the language input they receive is in another language (Scheele et al., 2010; Van Druten-Frietman et al., 2015). The mother's educational level also has an impact on the quantity and quality of language input, with lower educated mothers often engaging in fewer reading activities with their children and, in general, using less abstract and challenging language (Van Kleeck et al., 1997). This is reflected in children having smaller vocabularies (Hoff, 2006). The current study confirmed the impact of the mother's educational level on vocabulary.

Furthermore, we hypothesized that the educational level of the mother would be reflected in the frequency of reading activities conducted at home and parents' degree of self-efficacy and that reading activities and parent self-efficacy would therefore contribute to vocabulary. Contrary to previous studies (Ebert et al., 2013; Walker et al., 2005) and to our expectations, the frequency of reading activities and parent self-efficacy did not contribute to children's vocabulary in the current study. We therefore need to consider the appropriateness of the measures identifying reading activities and parent self-efficacy. With regard to reading activities, we measured the frequency of reading activities taking place at home (for example the frequency of shared book reading) rather than the quality of these reading activities (for example whether parents asked their child questions during book reading). Because vocabulary is influenced by both the quantity and the quality of reading activities, this might explain why the reading questionnaire did not predict vocabulary in this study.

The parent self-efficacy measure used in the current study consisted of general self-efficacy statements (such as 'I can motivate my child') that did not directly relate to parent's self-efficacy in the realm of parent-child interaction or vocabulary stimulation. We recognize that the parental self-efficacy questionnaire used in the current study may have been too general to establish a relationship with children's vocabulary. Finally, there are two methodological issues that may explain the unexpected findings. It is possible that the help provided to parents with lower language skills resulted in socially desirable outcomes. Also, the modest reliability of both measures shows that items on the questionnaires did not measure a coherent construct. Reading activities and parents' self-efficacy in literacy activities with their children are presumably important for children's vocabulary, but we were not able to demonstrate this relationship in our study. Despite this, the family context explained 30% of the variance, confirming that the family context plays an important role in children's vocabulary.

This study is among the first to demonstrate that, in addition to the family context and children's age, EF and SF of children predict their preschool vocabulary. EF proved to be a significant and very robust predictor of vocabulary. This finding shows that children who are able to control and regulate their social and cognitive behavior have larger vocabularies. It indicates that EF helps children to control social interactions in such a way that they obtain the linguistic input that they are in need of. This strongly suggests that being able to make adaptive changes in social environments, in order to execute appropriate social interactions, and to inhibit inappropriate interactions stimulates children's vocabulary. With regard to the ability to control cognitive behavior, EF supports processing of multiple streams of language input at the same time and storing this information. Whereas recent research has shown the contribution of EF to children's communicative behavior and vocabulary (Moriguchi, 2014; Weiland et al., 2014), this study highlights its robustness because it was examined in conjunction with firm family contextual factors.

Moreover, SF also contributes to vocabulary. This finding underlines the social dimension of vocabulary learning. Children who engage in more interactions seem to have larger vocabularies (McClelland et al., 2000; Vitiello & Williford, 2016). SF significantly and strongly contributed to children's vocabulary, even when including EF and family contextual factors. This emphasizes the strong and unique role of SF in preschool vocabulary. This finding suggests that the ability to sustain a social interaction is necessary to bring language into practice and to acquire vocabulary from linguistic input. In general, children with higher SF make contact more easily and are involved in more verbal interactions, resulting in larger vocabularies (Vitiello & Williford, 2016) and higher academic performances (McClelland et al., 2000). Understanding the reciprocal nature of social interactions allows children to enter into conversations and to sustain interactions.

There are some limitations to this study. First, vocabulary, the family context and the child's functioning were measured at the same time. Therefore, it is important to note that the relations are correlational and not causal. Second, all measures assessed in the child (vocabulary and EF tasks) were administered in Dutch. It was not possible to administer tests in the native language of the L2 children. The sample consisted of 48 different native languages and not all parents could speak Dutch which did not allow us to translate the task. The instructions and task were in Dutch, which might have resulted in L2 children scoring lower. The working memory task consisted of strings of common Dutch one-syllable words and this particular task might have been more difficult for the L2 children than for the L1 children because some words might have been unfamiliar to the L2 children. However, means and standard deviations did not show floor effects for L2 children indicating that they were familiar with the Dutch words. As Wiebe et al. (2011) stated, EF tasks should draw on basic concepts that children from all backgrounds might have mastered. Even though the multiple-task approach provided a robust measure of children's EF, future studies should consider less language-dependent EF tasks. In addition, we consider vocabulary to develop via interaction and therefore it would have been of great value to include a more direct measure of parent-child interaction (for example, observation of a shared book reading activity) in the study design.

To conclude, this study shows that cognitive and social abilities both play an important role in the vocabulary of preschool children, even when taking into account firm family contextual factors. The impact of linguistic diversity and education of the mother emphasizes that EF and SF need to be investigated in conjunction with the family context. As both a child's functioning and the family context are very meaningful at this age, educational policy should focus on stimulating a child's functioning within the home environment by, for example, home literacy programs (Van Steensel, McElvany, Kurvers, & Herppich, 2011). This is especially of importance in the Netherlands where children receive very limited hours of preschool per week and much therefore depends on the home situation. The current study suggests, that the curriculum of these home literacy programs would be more effective when activities are included stimulating cognitive and social abilities of children as both dimensions were proved to be significant predictors of preschool vocabulary.

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Appendix A

Questionnaire: reading activities			
English translation			
How often do you do the following activities?			
1. Reading books, magazines, newspapers	Often	Sometimes	Never
2. Reading to your child(ren)	Often	Sometimes	Never
3. Telling stories to your child(ren)	Often	Sometimes	Never
4. Going to the library with your child(ren)	Often	Sometimes	Never
How often does your child do the following activities?			
5. Read books	Often	Sometimes	Never
6. Play educational games (memory puzzles, dominoes)	Often	Sometimes	Never
7. Play educational games on the computer/tablet/phone	Often	Sometimes	Never
8. 8Watch educational TV programs	Often	Sometimes	Never

Appendix B

Questionnaire: parent self-efficacy			
English translation			
Do you agree with the following statements?			
1. I can help my child with learning new things	Yes	A little	No
2. I can motivate my child	Yes	A little	No
3. I know how to help my child with learning new things	Yes	A little	No
4. Sometimes I find it difficult to get through to my child	Yes	A little	No
5. I am more influential for my child than the preschool teachers	Yes	A little	No
6. I cannot help my child with learning difficult things	Yes	A little	No
7. I am important for the development of my child	Yes	A little	No

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