



## Bidirectional associations between vocabulary and self-regulation in preschool and their interplay with teacher–child closeness and autonomy support<sup>☆</sup>



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### ABSTRACT

In the present study, we examine the bidirectional associations between child vocabulary and self-regulation and their interplay with two relational dimensions, teacher–child closeness and autonomy support in preschool. Participants were 208 young children (50% boys;  $M=4$  years and 11 months,  $SD=0.71$ ) from socially disadvantaged areas in Portugal. Self-regulation and vocabulary were assessed at the beginning and end of the year. Teachers reported on levels of teacher–child closeness and autonomy support. A series of path analyses were conducted and tests of direct and indirect effects were included in the models. Results showed bidirectional effects between self-regulation and vocabulary, such that self-regulation at the beginning of preschool was a significant predictor of expressive vocabulary at the end of preschool year, and receptive vocabulary skills at the beginning of preschool year predicted self-regulation at the end of preschool year, controlling for earlier receptive vocabulary and self-regulation skills. In addition, teacher–child closeness uniquely predicted expressive vocabulary, whereas teacher autonomy support uniquely predicted self-regulation.

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Recently, there prevails an increased interest in understanding the associations between the development of self-regulation skills and other early academic skills in preschool, including vocabulary skills (Weiland, Barata, & Yoshikawa, 2014). Self-regulation skills have been considered to be a cornerstone of child development and have been linked to language, mathematics and social development (Blair & Razza, 2007; Graziano, Reavis, Keane, & Calkins, 2007; Howse, Calkins, Anastopoulos, Keane, & Shelton, 2003; Liew, Chen, & Hughes, 2010; McClelland et al., 2007; Valiente, Lemery-Chalfant, & Swanson, 2010; Wanless et al., 2011). Young children's vocabulary skills are also critically important for early school success (Justice, Bowles, Pence Turnball, & Skibbe, 2009), and such skills have been associated with literacy development and school

readiness (Rimm-Kaufman, Pianta, & Cox, 2000; Storch & Whitehurst, 2002; Whitehurst & Lonigan, 1998).

Despite the importance of both early vocabulary and self-regulation skills for later academic and social success (McClelland et al., 2007; Storch & Whitehurst, 2002), the way these two developmental skills influence one another throughout time remains less understood. Fuhs and Day (2011) contend that there exists a strong empirical support such that self-regulation and vocabulary skills are interrelated, particularly at younger ages; as it is being so, it is still unclear whether the relationship between the two constructs is bidirectional or whether their development overlaps but without necessarily influencing one another.

Importantly, it has been suggested that the study of relational aspects of development such as teacher–child relationships can elucidate about how the development of different domains is intertwined over time (Downer, Sabol, & Hamre, 2010; Graziano et al., 2007; Portilla, Ballard, Adler, Boyce, & Obradović, 2014). While far more studies have adopted a domain-specific approach, examining the extent to which a particular relationship dimension affects one specific developmental domain, studies recently started to examine how domains of teacher–child relationships independently and

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in combination contribute to cross-domain effects on child development (Hamre, Hatfield, Pianta, & Jamil, 2014).

The present study contributes to this recent body of knowledge by examining the co-development of self-regulation and vocabulary, within the context of teacher–child relationships. Specifically, we examine the interplay of vocabulary and self-regulation with two relational dimensions, teacher–child closeness and autonomy support. Investigating reciprocal associations between developmental and relational processes can contribute to a better understanding of the nuances and mechanisms underpinning the development and interrelationship of vocabulary and self-regulation.

## 1. Co-development of self-regulation and language skills

### 1.1. Self-regulation

Self-regulation is widely recognized as a critical ingredient of school readiness and early school success, with a growing body of research demonstrating links between self-regulatory capacities and early academic competence (Blair, 2002; Blair & Razza, 2007; McClelland, Acock, & Morrison, 2006; McClelland et al., 2007; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008). According to the cognitive model, self-regulation refers to the processes involved in children's attempts to control thoughts, emotions, and behavior in order to act appropriately in a given situation (Liew, 2012; McClelland & Cameron Ponitz, 2012; McClelland, Cameron Ponitz, Messersmith, & Tominey, 2010). It includes the abilities to shift and focus attention, ignore irrelevant, distracting information, to activate and inhibit behavior, and to store and retain important information (McClelland et al., 2007; Morrison, Cameron Ponitz, & McClelland, 2010; Wanless et al., 2011). Self-regulation is therefore involved in controlling, directing and planning behavior (McClelland et al., 2007).

Self-regulation abilities may support children's interactions within social settings helping children to adapt to and to get the most from the classroom environment (Bohlmann & Downer, 2016; Liew et al., 2010; Morrison et al., 2010). More specifically, children with high levels of self-regulation are better able to direct attention to targeted tasks (e.g., listening to the teacher) while ignoring external distractions, remember and follow multiple task instructions, switch between tasks and stop inappropriate responses that could otherwise disrupt classroom activities (Cameron Ponitz, McClelland, Matthews, & Morrison, 2009; McClelland et al., 2007; Morrison et al., 2010). Self-regulation skills may facilitate learning as they support crucial behaviors that allow children to more easily understand teacher directions, work independently, move between activities in the classroom and when necessary, engage in activities that enhance their emerging skills, including higher level cognitive abilities (Blair & Diamond, 2008; Fuhs, Nesbitt, Farran, & Dong, 2014; Morrison et al., 2010).

Self-regulation skills in preschool may have an important influence on the development of vocabulary (Cameron Ponitz et al., 2009; McClelland et al., 2007). For instance, in a study by McClelland et al. (2007), self-regulation of preschoolers observed in the fall was a positive predictor of achievement levels in vocabulary in spring. Furthermore, gains in self-regulation from fall to spring predicted growth in vocabulary in preschool (McClelland et al., 2007). In another study, children's early regulatory skills were positively associated with later expressive vocabulary skills, partially through engagement with the learning tasks and other typical activities in the classroom, such as play and lunch (Bohlmann & Downer, 2016). Findings suggested that self-regulation facilitated sustained and active engagement in activities where conversations

and talk were common, enabling the child to practice and enhance vocabulary skills (Bohlmann & Downer, 2016).

### 1.2. Vocabulary

Young children's verbal ability, including both receptive and expressive vocabulary, is also considered a critical precursor to school achievement and progress (NICHD Early Child Care Research Network, 2005; Storch & Whitehurst, 2002). There is ample evidence showing that children's vocabulary skills in preschool predict later reading competence and academic achievement in elementary school (e.g., Dickinson McCabe, Anastasopoulos, Peisner-Feinberg, & Poe, 2003; NICHD Early Child Care Research Network, 2005; Storch & Whitehurst, 2002). Receptive vocabulary appears to be especially important for later language and academic outcomes, with results from multiple studies providing evidence that children who have stronger receptive vocabulary skills tend to have better language, reading, and literacy skills in preschool and elementary school (Dickinson & Porche, 2011; Justice et al., 2009; Sénéchal & LeFevre, 2002). Indeed, the developmental continuity between receptive and expressive vocabulary is well documented (Benedict, 1979; Clark & Hecht, 1983; Fenson et al., 1994; Justice, Cottone, Mashburn, & Rimm-Kaufman, 2008). Particularly for preschool-age children, it has been shown that receptive vocabulary precedes expressive vocabulary and tends to be significantly more advanced. Prior research has shown that receptive vocabulary, rather than expressive vocabulary, is even a better predictor of later expressive vocabulary (Fenson et al., 1994; Fisher, 2017; Justice et al., 2008, 2009), making receptive vocabulary a robust, foundational skill for the acquisition and development of expressive vocabulary.

Receptive vocabulary can also contribute to the development of self-regulation skills. According to Vygotsky (1998), self-regulation is developed through a process in which children learn their culture's symbols and thought patterns. According to this perspective, caregivers play a central role in regulating children's behavior by talking to them and providing verbal cues. Children's growing representational abilities support the transition from other-regulation to self-regulation. As young children's vocabulary grows, their ability to understand internal states, to comprehend verbal instructions from others, or to think about rules increases, which facilitates reflection and awareness of their actions (Carlson & Beck, 2009; Fuhs & Day, 2011; Roben, Cole, & Armstrong, 2013; Vallotton & Ayoub, 2011). Children's vocabulary becomes a tool to guide and regulate behaviors (Alarcoín-Rubio, Sánchez-Medina, & Prieto-García, 2014). Previous studies provide some evidence that stronger receptive vocabulary is linked to self-regulation (Fuhs & Day, 2011; Hongwanishkul, Happaney, Lee, & Zelazo, 2005).

### 1.3. Interplay between self-regulation and vocabulary

However, the direction and strength of the developmental pathways between self-regulation and vocabulary in preschool have been scarcely considered. Only a handful of studies investigated the associations between change in self-regulation and vocabulary gains over time, and results have been mixed. In one of the few studies, Fuhs and Day (2011) found no reciprocal relations between the two domains, but rather an effect of vocabulary on later self-regulation skills, controlling for initial levels of self-regulation skills. In contrast, Weiland et al. (2014) found that self-regulation skills at the beginning of preschool significantly predicted receptive vocabulary at the end of preschool, controlling for initial levels of vocabulary, and that vocabulary did not predict self-regulation skills at the end of preschool, controlling for initial levels of self-regulation. Fuhs et al. (2014) found bidirectional associations between self-regulation abilities and language skills.

Contrary to the authors' hypothesis, language in kindergarten was predicted by gains in self-regulation skills (Fuhs et al., 2014). Similarly, in one study examining the links between self-regulatory processes and vocabulary development in monolingual and dual language learners in preschool, Bohlmann, Maier, and Palacios (2015) found support for bidirectionality between these developing skills. Possible reasons for the inconsistent findings are differences in measurement and control variables (Weiland et al., 2014), as well as measurement time. For instance, according to Cameron Ponitz et al. (2009), it is possible that self-regulation facilitates learning in diverse aspects of early achievement during preschool, but in kindergarten its effects become more domain specific, and gains in self-regulation may no longer predict language skills.

Clearly, there is a need for additional studies on the direction and strength of the developmental associations between self-regulation and vocabulary skills. Importantly, it has been suggested that self-regulation and vocabulary skills are contextually embedded and that particular aspects of the context, namely teacher–child relationships, are influenced and may influence both vocabulary and self-regulation (Graziano et al., 2007; Liew et al., 2010; Wolter, Glüer, & Hannover, 2014). Examining the interplay among vocabulary development, self-regulation, and relational aspects of development can aid in our understanding of how self-regulation and vocabulary develop over time and how they influence one another.

## 2. Domain-specific and cross-domain effects of teacher–child relationships

The quality of children's relationships with their teachers has been increasingly recognized as a key developmental context for children (Verschuere & Koomen, 2012). A robust body of research has consistently shown that young children's relationships with teachers are key precursors of later school adjustment and success (Hamre & Pianta, 2001; O'Connor & McCartney, 2006; Pianta & Stuhlman, 2004). High-quality teacher–child relationships characterized by warmth and support have been linked to increased academic motivation, higher achievement, lower levels of problem behaviors, and higher social competence (Birch & Ladd, 1997; Buyse, Verschueren, Doumen, Van Damme, & Maes, 2008; Hamre & Pianta, 2001; Pianta & Stuhlman, 2004).

Recent research has attempted to examine how relationships and developmental processes are intertwined (Downer et al., 2010; Hamre et al., 2014). In one recent study, Hamre et al. (2014) found that a specific feature of teacher–child relationships, designated as responsive interactions, was linked to greater gains across several developmental domains, including language and self-regulatory competence. In addition, links between specific relational aspects and specific developmental domains were also found, namely the association between teachers' positive management of child behavior and children's self-regulation skills (Hamre et al., 2014). However, this study only looked at overall levels of classroom interactions, without taking into consideration the dyadic relationships between the teacher and each child. The examination of dyadic relationships can provide nuanced information relative to a particular child's experience that is not captured by overall classroom measures. In an attempt to extend this recent research, we examine two dimensions of teacher–child relationships at the dyadic level: closeness and autonomy support.

### 2.1. Closeness

Closeness refers to the degree of warmth and open communication in the relationship between the teacher and child (Pianta, 2001). From an attachment theory perspective, close teacher–child

relationships may enhance child learning by supporting children to feel secure and to rely on teachers as a safe haven, and by encouraging them to take risks and to actively explore the classroom environment (Verschuere & Koomen, 2012). In addition, when teachers have close warm relationships with children, teachers may be more motivated to provide extra supports to children (Pianta, Steinberg, & Rollins, 1995).

Some studies have shown a direct connection between teacher–child closeness and children's language growth (Hamre & Pianta, 2001; Liew et al., 2010; Spilt, Koomen, & Harrison, 2015). Within close relationships, teachers are likely to have more frequent, personalized, and well-tuned verbal interactions likely to support vocabulary growth (Dickinson et al., 2003; Spilt et al., 2015). For example, in one recent study (Wolter et al., 2014), it was found that close teacher–child relationships provided children with more opportunities to benefit from teacher's language modeling. Similarly, although far less studied, close teacher–child relationships have been linked to gains in child self-regulation skills over the preschool year (Cadima, Verschueren, Leal, & Guedes, 2016; Wilde et al., 2015).

### 2.2. Autonomy support

Autonomy support is an additional yet less explored dimension of teacher–child relationships. Autonomy support concerns the level of teachers' support of children's autonomy by respecting their ideas, offering choices, encouraging them to take initiative and stimulating them to explore their interests (Grolnick & Pomerantz, 2009; Skinner & Belmont, 1993; Skinner, Johnson, & Snyder, 2005). In an autonomy-supportive relationship, children express their views and opinions, which are valued and taken into account in their interactions with adults (Skinner et al., 2005). Conceptually, the experience of autonomy is expected to contribute to children's sense of ability to direct their own behaviors, to feel competent and accepted and to develop committed compliance, accepting responsibility for compliance with values (Ryan & Deci, 2000). It has been suggested that autonomy support can foster children's ability to regularly engage and persist on tasks, thus directly contributing to self-regulation (Davis, 2003). By supporting autonomy within the classroom, teachers can also improve children's persistence and motivation in learning tasks that may facilitate the acquisitions of vocabulary skills (Davis, 2003).

Autonomy support has been frequently explored in the parenting literature, with findings consistently linking autonomy support and self-regulation and, to a less extent, vocabulary skills (Bernier et al., 2010; Bindman, Pomerantz, & Roisman, 2015; Matte-Gagné & Bernier, 2011). For teachers, studies involving school-aged children have provided some evidence for the link between autonomy supportive teacher–child relationships and self-regulation and academic achievement (Bieg, Backes & Mittag, 2011; Schuitema, Peetsma, & van der Veen, 2016; Skinner & Belmont, 1993; Vansteenkiste et al., 2012).

In the early childhood literature, in line with sociocultural and constructivist perspectives, there is a broad agreement that children should be viewed as active learners, with several authors positing the importance of teaching practices that are flexible and adapted to children's individual needs, interests, and experiences (Perry, Donohue, & Weistein, 2007; Stipek, Feiler, Daniels, and Milburn, 1995). In one seminal work, Stipek et al. (1995) found that in classrooms in which teachers created a nurturing social climate, attend to children's individual needs and support their initiatives, children had higher scores in several motivation measures. More recently, Lerkkanen et al. (2016) have found that teaching practices that favored child autonomy, along with respect and sensitivity toward children, positively predicted children's reading and math skills over the first school year.

However, research in early childhood examining the effects of autonomy support, above and beyond other relational processes such as teacher warmth and closeness, is surprisingly scarce, limiting the conclusions that can be drawn regarding the unique influence of autonomy support on self-regulation and vocabulary skills.

### 3. Interplay between self-regulation, language, and teacher–child relationships

More recent studies have suggested a dynamic interplay between children's skills and relational processes on child development, providing some support for developmental cascades through which children's development and their relationship quality mutually influence one another over time (Doumen et al., 2008; Portilla et al., 2014; Roorda Verschuere, Vancraeyveldt, Van Craeyveldt, & Colpin, 2014; Wilde et al., 2016). From a theoretical perspective, this process is explained by ecological and transactional models positing that the development of children can be either facilitated through high-quality teacher–child relationships or undermined by poor relationships (Masten et al., 2005; Spilt et al., 2015). Children's behaviors and characteristics, namely, social–emotional adjustment, temperament and self-regulation (Birch & Ladd, 1998; Blair, McKinnon, & Family Life Project Investigators, 2016; Mejia & Hoglund, 2016; Myers & Pianta, 2008) appear to influence the way teachers interact with them which, in turn, may further contribute or impede children's further development. For instance, in one study, Spilt et al. (2014) found reciprocal associations between close teacher–child relationships and receptive vocabulary development over time. However, even though there is some support suggesting spreading effects of one developmental domain to another over time (Masten et al., 2005), studies examining the developmental links between vocabulary and self-regulation development within and across relationship quality domains are quite limited.

Similar to teacher–child closeness, the levels of autonomy support provided by the teacher can also be shaped by children's competence. It is possible that preschool teachers adjust the levels of autonomy support to children's skills, which then provide an important context for learning. However, to our knowledge, this reciprocal association has never been investigated in the literature.

In sum, there is increased conceptual and empirical ground highlighting the dynamic, interactive, and contextually embedded nature of developmental processes (e.g., Bohlmann et al., 2015; Fischer & Bidell, 2006) suggesting that distinct domains of development such as vocabulary and self-regulation mutually influence one another and interact with relational domains over time (Bohlmann et al., 2015; Fuhs et al., 2014). However, although reciprocal influences between teacher–child relationships and children's vocabulary and self-regulation are generally assumed, most research has only examined unidirectional effects and far less is known about how vocabulary and self-regulation and relationship processes reciprocally relate over time. In addition, whereas some research has suggested cross-domain links between relationships and child development (Hamre et al., 2014), research is still very limited, particularly in regard to autonomy support.

The interplay between vocabulary development, self-regulation and teacher–child relationship is particularly important to examine among children from socially disadvantaged backgrounds. It has been shown that there is considerable variability in self-regulation and vocabulary skills among young children due to their family context (Ackerman, Brown, & Izard, 2004; Burchinal, Roberts, Zeisel, Hennon, & Hooper, 2006; Mezzacappa, 2004; Noble, Norman, & Farah, 2005; Sektan, McClelland, Acock, & Morrison, 2010). Like in many other western countries, in Portugal, family risk factors,

such as low family income, low occupational status, and in particular, low maternal education, adversely impact child development, accounting for important differences in children's skills even before elementary school (Cadima, Gamelas, McClelland, & Peixoto, 2015; Cadima, McWilliam, & Leal, 2010). However, in contrast with other countries, Portugal faces one of the highest rates of school dropout in Europe, and upper secondary enrollment rates are relatively low (OECD, 2016). It seems therefore particularly important to identify effective means that can contribute to prevent later academic difficulties by understanding the interrelatedness between features of teacher–child relationships and the development of foundational skills.

### 4. The current study

The present study investigates the dynamic interplay between two relevant developmental processes, vocabulary and self-regulation, and two relationship processes, teacher–child closeness and autonomy support, in preschoolers from socially disadvantaged backgrounds. We first examine the bidirectional associations between vocabulary and self-regulation at the beginning and the end of the preschool year. Consistent with recent research (Bohlmann et al., 2015; Fuhs et al., 2014), it is expected that there will be a bidirectional association between self-regulation and language skills. Second, we examine the reciprocal associations between vocabulary and self-regulation and two relationship dimensions, teacher–child closeness and autonomy support. Specifically, we examine whether receptive vocabulary and self-regulation at the beginning of the preschool year influence teacher–child closeness and autonomy support at the middle of the preschool year and, in turn, whether teacher–child closeness and autonomy support influence expressive vocabulary and self-regulation at the end of the preschool year. Regarding closeness, based on previous research (Hamre et al., 2014; Schmitt, Pentimonti, & Justice, 2012; Spilt et al., 2015), we expect both vocabulary and self-regulation to affect and be affected by teacher–child closeness. For autonomy support, no clear expectations can be formulated regarding whether vocabulary or self-regulation are linked to autonomy support, although it is conceivable to hypothesize that autonomy support will be especially important for self-regulation gains. By testing in one model the joint effects of two developmental processes (i.e., vocabulary and self-regulation development), we can disentangle the unique contribution of vocabulary and self-regulation to relationship quality, while also examining how teacher–child closeness and autonomy support in turn influence the further development of vocabulary and self-regulation.

## 5. Method

### 5.1. Participants

The dataset used in the current sample was part of a larger research project intended to examine the growth of self-regulation in at-risk preschool children and its links with the quality of preschool teacher–child interactions. The project was run in socially disadvantaged areas situated in the large metropolitan area of Porto, Portugal. Schools were selected based on their participation in the Priority Intervention Territories Program (TEIP). The TEIP program is a nationally-funded action that targets public schools serving high-risk populations that are at risk for poverty and social exclusion. The program allocates more economic and human resources, such as more teachers, assistants and specialized staff (e.g. social workers, social educators, psychologists) to improve students' academic success and decrease early school leav-

ing. It is worth mentioning that the program does not incorporate specific curriculum content and that teachers in this program are expected to follow the national curriculum guidelines, and thus activities and materials are similar to the other preschool classrooms. Participating classrooms were followed in two consecutive years. In each year, five children per classroom were randomly selected and followed throughout the year. Participants in this study were 208 children (50% boys) followed in the second year of the study. Children's age varied between 36 and 78 months ( $M = 4$  years and 11 months,  $SD = 0.71$ ) at the beginning of the school year. Forty-seven percent of the mothers had at most nine years of schooling; 24% attended secondary school (12 years), a rate that is below the 32% for the national educational levels (INE, 2012; OECD, 2013). Twenty-nine percent of the mothers were unemployed, a considerably higher rate than the national rate of 13%. The household monthly income for 36% of the families was below the National Minimum Wage (NMW), which is well above the national rate of 13.5% of families with incomes below the NMW. The NMW is equivalent to 485€ a month (which is equivalent to about \$600 USD), and 5820€ a year (equivalent to \$7162 USD).

Forty-seven classrooms were utilized. Classrooms averaged 21.75 children ( $SD = 3.14$ ), and most classrooms had one (28%) or two adults (59%) assisting the head teacher. The majority of classrooms (83%) had at least four participating children. Preschool teachers (100% women) had on average 26 years ( $SD = 6.35$ ) of teaching experience in preschool. All teachers had a professional certificate in Early Childhood. The preschool teachers in Portugal are required to hold at least a Bachelor's degree in Early Childhood, which involves the completion of a three years training program in either a teacher training college or a university. Preschool in Portugal is part of the national education system for children aged 3–5 and, although not compulsory, the attendance rate is relatively high at 93% (European Commission/EACEA/Eurydice/Eurostat, 2014).

## 5.2. Procedure

Data were collected across the preschool year (in Portugal, the school year runs from September to June). Before data collection, measures and procedures were approved by the Portuguese Data Protection Authority and informed consent was obtained from teachers and parents. Children's self-regulation and vocabulary were both assessed at the beginning (from October to December) and end (from May to June) of the preschool year. Child assessments were conducted individually with trained research assistants in a quiet room at the child's preschool center. Teachers were asked to rate levels of closeness and autonomy support at the middle of the school year (from January to April 2014).

## 5.3. Measures

### 5.3.1. Direct observation of self-regulation

The Head-Toes-Knees-Shoulders task (HTKS; Cameron Ponitz et al., 2009) was used to assess components of self-regulation, such as attention focusing, working memory and inhibitory control, in a short game that involves gross motor movements (Cameron Ponitz et al., 2009; McClelland & Cameron, 2012). The HTKS was designed to assess the integrative nature of self-regulation in an ecologically valid manner, covering aspects of self-regulation similar to the behaviors commonly required from children in school contexts (Cameron Ponitz et al., 2009; McClelland & Cameron Ponitz, 2012). The task includes 20 items organized in two parts involving paired rules: a head-toes section (10 items), in which children are instructed to touch their head when told to touch their toes and vice versa, and the head-toes-knees-shoulders section (10 items), in which the knees-shoulders paired command is added, and children

are additionally instructed to do the opposite in response to the assessor's prompts. Each of the 20 items is scored from 0 (incorrect response) to 2 (correct response). The task has been found to be reliable in many countries in America, Asia, and Europe (Fuhs, Farran, & Nesbitt, 2013; McClelland & Cameron, 2012; von Suchodoletz et al., 2013; Wanless et al., 2011). In the current study, Cronbach's  $\alpha = .94$  and  $\alpha = .93$ , respectively at the beginning and end of the preschool year. HTKS score range from 0 to 40, with higher scores corresponding to higher levels of self-regulation.

### 5.3.2. Beginning of the year receptive vocabulary

The Peabody Picture Vocabulary Test-Revised (PPVT-R; Dunn, 1986) was used to assess receptive vocabulary at the beginning of the preschool year. In this task, the child is presented with four pictures and asked to point to the one that matches the word read aloud by the researcher. It consists of 115 items of increasing difficulty. Each item is scored 0 (incorrect response) or 1 (correct response). This measure has been widely used and has shown strong validity properties. The translated Portuguese version has shown acceptable reliable and valid scores for preschoolers (e.g., Bairrão, Leal, Fontes, & Gamelas, 1999). In the current study, Cronbach's  $\alpha = .82$ . Higher scores on this measure indicate higher levels of receptive vocabulary skills.

### 5.3.3. End of the year expressive vocabulary

The Vocabulary subtest of the Wechsler Preschool and Primary Scale of Intelligence (WPPSI-R; Wechsler, 2010) was used to assess children's vocabulary at the end of the preschool year. In this task, the child is asked to give definitions of a particular word. The task consists of 21 items, and a total is obtained by summing across the items. The item's score can vary from 0 to 2. The WPPSI is a widely used, well-validated test with highly reliable and valid scores (Wechsler, 2003). In the current study, Cronbach's  $\alpha = .87$ . Higher scores on this measure indicate higher levels of expressive vocabulary skills.

### 5.3.4. Teacher-child closeness

To assess teachers' perceptions of closeness, we used the Student-Teacher-Relationship-Scale (STRS, Pianta, 2001). The closeness subscale assesses teacher perceived warmth and open communication with the child (e.g., "This child openly shares his/her feelings and experiences with me"). A 5-point Likert-type scale is used ranging from 1 (*definitely does not apply*) to 5 (*definitely applies*). The reliability and validity of the measure have been established across different samples (Doumen, Koomen, Buyse, Wouters, & Verschueren, 2012; Hamre & Pianta, 2001). In the present study, the one-factor model provided an adequate fit to the data,  $\chi^2(15) = 48.51, p < .01$ ; CFI = .941; TLI = .890; RMSEA = .106, after excluding two items from the closeness scale that had low factor loadings: "This child is uncomfortable with physical affection or touch from me (reversed)" and "This child tries to please me". All factor loadings exceeded 0.40 and Chronbach's  $\alpha = .78$ . A total score was computed by averaging the items, with higher scores indicating higher levels of closeness.

### 5.3.5. Teacher-child autonomy support

Autonomy support was assessed using 9 items of the subscale Autonomy support from the Teacher as Social Context Questionnaire (TASC; Wellborn, Connell, Skinner, & Pierson, 1992; Portuguese version by Wellborn, Connell, Skinner, Pierson, 2013). This subscale focuses on teacher's behavior toward each child in his or her classroom and taps teacher *controlling behavior* (e.g., "I have to lead this child through his/her schoolwork step by step"; reversed coded), choice (e.g., "I try to give this child a lot of choices about classroom assignments"), and respect ("I let this child make a lot of his/her own decisions"). Items are rated on a 4-point-scale,

**Table 1**  
Descriptive statistics and correlations among variables.

	M (SD)	Range	1.	2.	3.	4.	5.	6.	7.	8.
1. Sex	0.5									
2. Age	59.44 (8.54)	35–78	.08							
3. Maternal education	9.1 (3.20)	1–18	.14	.14						
4. Receptive vocabulary T1	33.4 (15.09)	2–75	.01	.59*	.31*					
5. Self-regulation T1	20.2 (14.11)	0–40	.13	.47*	.23*	.65*				
6. Expressive vocabulary T2	19.9 (6.63)	0–36	.06	.50*	.11	.61*	.51*			
7. Self-regulation T2	27.4 (12.29)	0–40	.04	.49*	.19*	.56*	.63*	.51*		
8. Closeness	4.1 (0.74)	1.6–5.0	.03	.16*	.20*	.32*	.25*	.44*	.26*	
9. Autonomy support	3.1 (0.72)	1.3–4.0	.17*	.07	.07	.30*	.31*	.26*	.31*	.32*

from 0 (*not at all true*) to 3 (*very true*). Results of confirmatory factor analysis on this sample found that one factor model provided an adequate fit for the data,  $\chi^2(15) = 48.51, p < .01$ ; CFI = .941; TLI = .890; RMSEA = .106, with all factor loadings exceeding 0.40. Chronbach's  $\alpha = .86$ . A total score was computed by averaging the positive and the reverse coded negative items, with higher scores indicating higher levels of autonomy support.

### 5.3.6. Covariates

To better isolate the unique influence of each variable on the outcomes at the end of the preschool year, we considered a set of covariates. Child covariates included age and sex retrieved from school records. Family covariates included maternal education reported by the mother through a questionnaire.

### 5.4. Analytic approach

A series of models were tested to answer our research questions. First, four conditional models were computed to determine which model best represented the associations between vocabulary and self-regulation: no cross-lagged associations, unidirectional association (self-regulation predicting vocabulary), unidirectional association (vocabulary predicting self-regulation), and bidirectional associations. Second, closeness and autonomy support were added to the model. In the models, a clustering adjustment was used to address the issue of nesting of children within classrooms, using the special feature for complex survey that uses the maximum likelihood with robust standard errors (MLR) and corrects the standard errors to take into account the non-independence of observations. To assess model fit, we examined the chi-square test, comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR; Hu & Bentler, 1999). Differences in model fit were tested using the Satorra–Bentler scaled Chi-square difference test that uses a scaling correction factor to address nesting. A set of covariates were entered into the models, namely child age and sex, and maternal education. The covariates were allowed to correlate with self-regulation and vocabulary at both moments, as well as with closeness and autonomy support, with non-significant paths removed to obtain the most parsimonious model, after careful examination of model fit. In the final model, the direct and indirect effect coefficients were modeled simultaneously, and significance tests for each separate path were obtained. More specifically, to test whether children's vocabulary or self-regulation at the beginning of the year were associated with later outcomes at the end of the year via relationship processes, indirect effects were added to the model. The significance of each indirect effect was estimated using a bootstrapping procedure with 2000 resamples (Preacher & Hayes, 2008). Complete data were available for all 208 children for child age, gender, vocabulary and self-regulation at the beginning of the school year. Vocabulary and self-regulation at the end of the school year, as well as closeness and autonomy support had less than 5% missing data. Maternal education had 25% missing data. Miss-

ingness on this variable was not associated with any of the other variables, with correlations varying from  $r = -.06$  to  $r = .13$ . Missing data were handled using full information maximum likelihood estimation (FIML) to prevent sample size reduction and subsequent loss of statistical power (Enders, 2001). All models were estimated using the Mplus software (Muthén & Muthén, 1998–2010).

## 6. Results

Table 1 displays descriptive statistics and simple correlations for all variables.

Simple correlations indicated moderate to strong statistically significant associations between vocabulary and self-regulation at both time points. Correlations among the variables were relatively stable from the beginning to the end of the preschool year. Closeness and autonomy support were significantly and modestly related to vocabulary and self-regulation, and modestly related to one another. Child's age was positively correlated with vocabulary and self-regulation at both time points as well as with closeness. Child sex was associated with autonomy support, such that girls tended to receive higher levels of autonomy support. Maternal education was modestly related to receptive vocabulary at the beginning of the preschool year, closeness and self-regulation, both at the beginning and at the end of the preschool year.

Next, four conditional models were run to test the associations between vocabulary and self-regulation, using child age, child sex, and maternal education as covariates. Table 2 presents fit indices and chi-square difference tests of the conditional models. As shown, the bidirectional model had the best fit, with significant improvements in model fit over prior models. Fig. 1 displays the final model. Regarding auto-regressive paths, self-regulation at the beginning of the school year (time 1) moderately predicted self-regulation at the end of the school year (time 2),  $\beta = .52, p < .001$ . Receptive vocabulary at time 1 was also a moderate predictor of expressive vocabulary at time 2,  $\beta = .35, p < .001$ . Self-regulation at time 1 was strongly correlated with receptive vocabulary at time 1,  $r = .50, p < .001$ , whereas no statistically significant association was found between self-regulation at time 2 and expressive vocabulary at time 2,  $r = .12, p = .069$ . Regarding the bidirectional effects, self-regulation at the beginning of the preschool year was a modest predictor of expressive vocabulary at the end of the preschool year,  $\beta = .19, p = .013$ , and receptive vocabulary at the beginning of the preschool year modestly predicted self-regulation at the end of the preschool year,  $\beta = .18, p = .024$ .

Regarding the effects of the covariates, child age was a strong and significant predictor of both receptive vocabulary and self-regulation at the beginning of the preschool year, respectively,  $\beta = .58, p < .001$  and  $\beta = .50, p < .001$ , and it was a modest predictor of expressive vocabulary at the end of the preschool year,  $\beta = .20, p = .012$ . Maternal education was a modest predictor of receptive vocabulary at time 1,  $\beta = .17, p = .031$ . Child sex only made a modest contribution to the levels of self-regulation at the beginning of the school year,  $\beta = .15, p = .005$ .

**Table 2**  
Model fit indices for the four conditional models examining the associations between self-regulation and vocabulary.

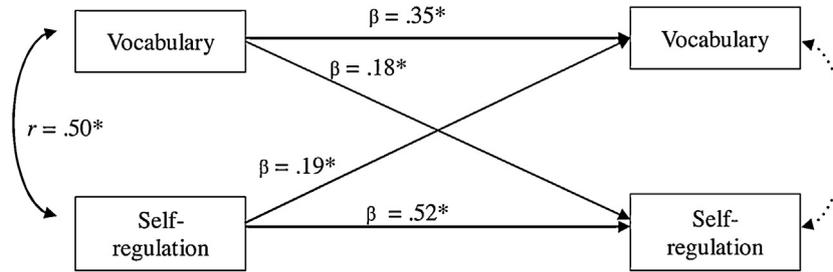
	$\chi^2(df)$	CFI	RMSEA	SRMR	$\Delta\chi^2(df)^a$
1. Auto-regressive paths	27.51* (11)	.960	.086	.082	
2. Unidirectional (Self-reg T1 → Vocab T2)	21.49* (10)	.972	.075	.074	
Difference between Model 2 and Model 1					5.15* (1)
3. Unidirectional (Vocab T1 → Self-reg T2)	21.75* (10)	.972	0.076	0.070	
Difference between Model 3 and Model 1					5.87* (1)
4. Bidirectional	15.65 (9)	.984	.060	.063	
Difference between Model 4 and Model 2					5.84* (1)
Difference between Model 4 and Model 3					5.12* (1)

Note: The models included as covariates child age, child sex, and maternal education.

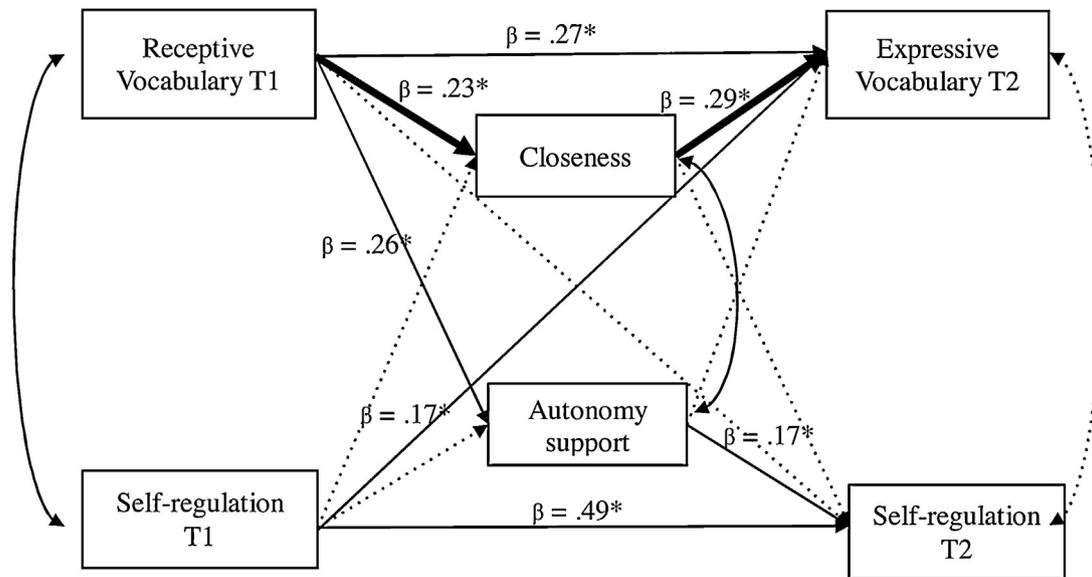
CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

<sup>a</sup>The chi-square difference test was computed using the Satorra–Bentler scaling correction factor provided in Mplus for complex designs.

\* $p < .05$ .



**Fig. 1.** Summary of the path model examining the associations between self-regulation and vocabulary at the beginning and end of the preschool year. The model included as covariates child age, child sex, and maternal education. Dotted lines represent non-significant paths. Standardized coefficients are displayed. \* $p < .05$ .



**Fig. 2.** Summary of the path model examining the associations between self-regulation and vocabulary at the beginning and end of preschool, and levels of dyadic teacher–child closeness and autonomy support. The models included as covariates child age, child sex, and maternal education. Standardized coefficients are displayed. Dotted lines represent non-significant paths. Bolded lines indicate indirect effects. The indirect path between receptive vocabulary T1 and expressive vocabulary T2 via teacher–child closeness was statistically significant,  $\beta = .070$ ,  $SE = .031$ ,  $p = .025$  (Bootstrap 95% CI = .003; .089). \* $p < .05$ .

Next, a series of models were estimated examining the reciprocal associations between developmental processes (i.e., vocabulary and self-regulation), and relational processes (i.e., closeness and autonomy support). Fig. 2 presents the standardized coefficients of the final model. This model had an acceptable fit  $\chi^2(13) = 21.46$ ,  $p = .064$ ,  $RMSEA = .057$ ,  $CFI = .981$ ,  $SRMR = .056$ . After taking into account both receptive vocabulary and self-regulation at the beginning of the preschool, autonomy support uniquely predicted self-regulation at the end of the preschool year,  $\beta = .17$ ,  $p = .037$ , whereas teacher–child closeness uniquely predicted expressive vocabulary at the end of the preschool year,  $\beta = .29$ ,  $p = .001$  (see

Table 3). Children with greater levels of autonomy support showed higher levels of self-regulation at the end of the preschool year, whereas children who had closer relationships with their teachers showed higher levels of expressive vocabulary at the end of the preschool. Both teacher–child closeness and autonomy support were positively predicted by receptive vocabulary  $\beta = .23$ ,  $p = .008$  and  $\beta = .26$ ,  $p = .012$ , respectively, such that children who start the preschool year with higher levels of vocabulary tended to develop closer relationships with teachers and to receive higher levels of autonomy support from their teachers. Self-regulation at time 1 was not associated with closeness,  $\beta = .07$ ,  $p = .454$ , or auton-

**Table 3**  
Parameter estimates, standard errors, and standardized estimates of the final model examining reciprocal associations between vocabulary, self-regulation, closeness and autonomy support.

	Self-regulation T2			Expressive vocabulary T2		
	<i>Unst B</i>	<i>SE</i>	$\beta$	<i>Unst B</i>	<i>SE</i>	$\beta$
Self-regulation T1	0.23	.04	.49*	0.08	.03	.17*
Receptive vocabulary T1	0.06	.03	.14	0.12	.04	.27*
Closeness	0.18	.65	.02	2.63	.82	.29*
Autonomy support	1.56	.75	.17*	0.08	.43	.01
	<i>Closeness</i>			<i>Autonomy support</i>		
Self-regulation T1	0.00	.01	.07	0.01	.01	.19
Receptive vocabulary T1	0.01	.00	.23*	0.01	.01	.26*

Note.

The models included as covariates child age, child sex, and maternal education.

omy support,  $\beta = .19$ ,  $p = .052$ . Regarding the bidirectional effects between self-regulation and vocabulary, receptive vocabulary no longer predicted self-regulation skills at the end of preschool,  $\beta = .14$ ,  $p = .079$ , while self-regulation at the beginning of the year continued to predict expressive vocabulary at time 2,  $\beta = .17$ ,  $p = .011$ .

Given the significant pathway from vocabulary at time 1 to autonomy support, which in turn was positively related to self-regulation at time 2, we examined the significance of the indirect effect of these variables. The results showed that the indirect path of the effect of receptive vocabulary on self-regulation through autonomy support was not statistically significant,  $\beta = .051$ ,  $SE = .030$ ,  $p = .086$  (Bootstrap 95% confidence interval (CI) =  $-.005$ ;  $.080$ ). The indirect path of the effect of receptive vocabulary on expressive vocabulary via closeness was also tested. This indirect effect was statistically significant,  $\beta = .070$ ,  $SE = .031$ ,  $p = .025$  (Bootstrap 95% CI =  $-.003$ ;  $.089$ ), suggesting that higher levels of receptive vocabulary at the beginning of the preschool year affected expressive vocabulary at the end of the preschool year via closeness.

In regards to the effects of the covariates on closeness and autonomy support, child age and maternal education were not significantly associated with either closeness or autonomy support, but sex was a modest predictor of autonomy support,  $\beta = .17$ ,  $p = .021$ , such that girls tended to experience higher levels of autonomy support, when compared to boys.

## 7. Discussion

In this study, we investigated the dynamic interplay between two relevant developmental processes, vocabulary and self-regulation, and two relationship processes, teacher–child closeness and autonomy support in young children from socially disadvantaged backgrounds. Relatively few research studies have examined bidirectional associations between self-regulation and vocabulary within the context of relationships, and thus results of this study make a unique contribution to this literature by showing (a) bidirectional effects between self-regulation and vocabulary, controlling for initial levels; (b) a significant and positive association between close teacher–child relationships and expressive vocabulary at the end of the preschool year; (c) a significant and positive association between autonomy support and self-regulation at the end of the preschool year; and (d) positive associations between receptive vocabulary at the beginning of the preschool year and both closeness and teacher autonomy support at the middle of the school year.

### 7.1. Bidirectional effects between self-regulation and vocabulary

First, our results provided initial evidence of reciprocal relations between self-regulation and vocabulary. Findings from this

study indicated that self-regulation predicted expressive vocabulary at the end of the preschool year, controlling for initial levels of receptive vocabulary, and receptive vocabulary predicted self-regulation, controlling for initial levels of self-regulation. These findings are suggestive that self-regulation and vocabulary contribute to the development of one another, which are relevant for theoretical considerations about the dynamic, interactive nature of developmental processes (Fischer & Bidell, 2006). Prior research has shown inconsistent findings on bidirectionality between vocabulary and self-regulation (Bohlmann et al., 2015; Fuhs et al., 2011, 2014; Weiland et al., 2014). Consistent with more recent studies (e.g., Bohlmann et al., 2015; Fuhs et al., 2014), findings from the present study add to this recent literature by suggesting that skills in one domain might influence developing skills in another domain.

Importantly, after adding the relational processes into the model, self-regulation continued to be a positive predictor of expressive vocabulary, whereas receptive vocabulary no longer predicted self-regulation. The reduction of the effect of the receptive vocabulary on self-regulation may indicate possible mediation effects of relational features, as it will be further detailed. Worth noting, even though receptive vocabulary was the strongest predictor and a developmental precursor of expressive vocabulary, findings suggest that self-regulation may be particularly important for the acquisition and development of expressive vocabulary skills. By enabling children to adapt to classroom demands, through sustained attention and control of actions, self-regulation may help children to participate and get most out of the many formal and informal opportunities that involve talk and conversations (e.g., play; Bohlmann & Downer, 2016; McClelland et al., 2007; Schmitt et al., 2012).

### 7.2. Teacher–child closeness

The second finding of this study suggests that teacher–child closeness uniquely predicted expressive vocabulary at the end of the preschool year. This finding adds to the growing body of work showing the importance of warmth and open communication for vocabulary (Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002; Peisner-Feinberg et al., 2001; Spilt et al., 2015). It is possible that, within warm relationships, children feel more secure to explore and learn (Verschuere & Koomen, 2012), engaging more frequently in conversation with teachers and peers, and having more opportunities for language exchanges, answering questions and actively listening (Schmitt et al., 2012). It is also possible that within such positive relationships, children benefit from teacher's language modeling, contributing to growth in vocabulary (Schmitt et al., 2012; Wolter et al., 2014). In sum, it seems that language development is accelerated in the context of close teacher–child relationships.

However, contrary to our expectations, closeness did not predict self-regulation. Prior research has shown positive concurrent associations between closeness and self-regulation (Blair et al., 2016; Graziano, Ros, Hart, & Garcia, 2015), even though research is still quite limited. Our findings extend prior work by suggesting that, in more stringent models, closeness no longer predicts self-regulation. Although more research is needed, our findings suggest that there may be differential effects of closeness on different developmental domains. It seems that closeness, rather than having a general promotive effect, fostering developmental change on both domains (i.e., self-regulation and vocabulary), had a domain-specific effect on expressive vocabulary. It can be that the effect of closeness on self-regulation may be dependent on other contextual inputs, namely the quality of behavioral management or regular opportunities for children to engage in meaningful activities directly targeting self-regulation skills (Fuhs et al., 2014). It is possible that closeness promotes self-regulation when behavioral

management is high or when children have opportunities to practice their skills. Associations between closeness and self-regulation may also depend on child characteristics, such as age, temperament, and exposure to other close relationships (Justice et al., 2008; Verschueren & Koomen, 2012), however research is warranted in determining the relational processes and practices that actually increase self-regulation skills.

### 7.3. *Autonomy support*

In the present study, one important extension of prior work was the examination of the unique links between autonomy support and vocabulary and self-regulation. Our findings showed that autonomy support positively predicted child self-regulation, even when controlling for initial levels of self-regulation and other important covariates, namely child age, sex, and maternal education. Findings suggest that teachers can promote self-regulation skills by providing adequate levels of autonomy and responsibility, such as respecting child's opinions and ideas and supporting their interests. These findings extend previous research on autonomy-supportive parenting by suggesting that, similarly to parents, teachers can improve self-regulation by adopting autonomy-supportive behaviors. In addition, our findings add to previous work in early childhood that highlights the importance of providing children with opportunities to direct their own learning (e.g., Perry et al., 2007; Stipek et al., 1995) by showing the unique influence of autonomy support on self-regulation skills. It has been suggested that, in classrooms in which the teachers place greater emphasis on providing choices for children, children select more challenging and stimulating activities (Stipek et al., 1995). Activities that are challenging and relevant for children may represent good opportunities for children to practice their self-regulation skills, helping them to improve their attention shifting, focusing, and inhibitory control skills (Downer et al., 2010). It is also possible that, from a motivational perspective, taking children's perspective and encouraging self-initiation contribute to a better appreciation of the task's value and favor sustained engagement thereby helping children to regulate their attention and behavior (Joussemet, Koestner, Lokes, & Houliort, 2004). Importantly, despite several claims of the importance of child centered learning (e.g., Lerkkanen et al., 2016) findings from this study are among the first underscoring the unique influence of autonomy-support teaching for self-regulation in early childhood.

It is also noteworthy to mention that the association between teacher-child closeness and autonomy support was modest. Given the unique role of autonomy support in fostering children's self-regulation that we found in the current study, it may be interesting in future research to add this dimension to current models on dyadic teacher-child relationships.

### 7.4. *Reciprocal associations between vocabulary, self-regulation, and relational processes*

At last, the fourth major finding of this study showed that both teacher-child closeness and teacher autonomy support were positively influenced by children's receptive vocabulary skills at the beginning of the preschool year. It appeared that teachers tailor the levels of closeness and autonomy support in response to children's levels of receptive vocabulary (Mejia & Hoglund, 2016). Although it is not clear why vocabulary rather than self-regulation was associated with relational processes, it may be that language abilities are more salient for teachers and, according to their perceptions, a better proxy of children's overall development and levels of independence, whereas self-regulation skills may require a more refined judgment, as it can vary with teacher's expectations for the different activities. Good receptive language skills are necessary for

children to engage in frequent conversations and interactions with the teacher, which are very common in early childcare, while self-regulation skills may be prominent for teachers in specific activities, namely structured or teacher-directed activities. It is possible that teacher's expectations and judgment of self-regulation skills varies with the different learning situations in which the child is involved. Nevertheless, it seems necessary to replicate these findings and confirm these results, as future work with other samples may lead to different conclusions. Interestingly, girls received higher levels of autonomy support, compared to boys. It seems that teachers' levels of autonomy support are influenced by children's skills and characteristics, and that teachers adjust the way they respect and stimulate children's initiatives in response to children's individual characteristics.

### 7.5. *Limitations*

Results from this study need to be interpreted with some limitations in mind. First, self-regulation was measured using one task, the Head-Toes-Knees-Shoulders. Although this measure has established validity (Cameron Ponitz et al., 2009; Wanless et al., 2011; von Suchodoletz et al., 2013) and assesses the integrative nature of self-regulation, including attentional flexibility, working memory, and inhibitory control, the use of additional measures could strengthen our findings. Second, vocabulary at the beginning and end of the preschool year was assessed via two different measures. As previously mentioned, although receptive vocabulary has been found to be one of the best indicators of the overall language ability and a precursor of expressive vocabulary (Justice et al., 2009), more research is needed to examine in more detail reciprocal influences between self-regulation and expressive and receptive vocabulary. Third, teacher-child relationships were assessed at one time point, and therefore no inferences can be drawn about its stability and change, as well as the factors contributing to this stability and change. It also requires mention that teacher-child relationships were assessed via teacher reports and it would be useful for future research to include other informants' views. Finally, teacher-child relationships and children's self-regulation and vocabulary skills are also likely to be influenced by overall levels of classroom quality (e.g., Hamre et al., 2014). Therefore, future research on dyadic and classroom-level relationships could aid in our understanding of potential ways, in which relational and developmental processes (i.e., vocabulary and self-regulation) influence one another and have effects on subsequent developmental processes.

### 7.6. *Implications for research and practice*

In sum, in this study a first step was taken in understanding the cross-domain effects between vocabulary and self-regulation within the context of teacher-child relationships. These findings have both theoretical and practical implications. Although more research is needed, our findings suggest cross-domain effects between vocabulary and self-regulation. Our findings offer a more comprehensive picture of the role that vocabulary and self-regulation play on one another, which is consistent with theoretical views positing that the development of these skills occurs through a coactive process that is iterative in nature with spreading effects of one domain on the other (Fischer & Bidell, 2006; Masten et al., 2005). Accordingly, vocabulary and self-regulation can be viewed as dynamic skills simultaneously developing and influencing one another over time (Fischer & Bidell, 2006).

The suggestion that self-regulation and vocabulary can be improved via one another offers multiple avenues for intervention. Intervention programs and preschool curricula designed to improve school readiness may target language and self-regulation

skills simultaneously. An example of one such program is the Tools of the Mind (Bodrova & Leong, 2001), a comprehensive program that integrates self-regulation oriented activities within academic instruction and play. But it can be also possible to design smaller, more focused interventions that target either vocabulary or self-regulation at different developmental stages and time points, as a way to address challenges related to the implementation of comprehensive programs, namely fidelity of implementation.

Importantly, vocabulary and self-regulation skills appeared to be malleable to different domains of teacher–child relationship, suggesting that improving teachers' behaviors and perceptions through a relational lens may be an effective means to improve children's skills in these developmental domains (Sabol & Pianta, 2012). For closeness, professional development programs with an explicit focus on improving relationships within classroom contexts have the potential to improve teacher–child relationships and, in turn, improve children's vocabulary. Recent research has shown that relationship-focused programs can be effective in improving teacher sensitivity and teachers' perceptions of relationships with children (Sabol & Pianta, 2012).

Regarding autonomy support, it is important to note that autonomy support goes beyond warmth and respect, and requires from teachers high levels of attentiveness to children, by taking their perspective, considering their interests and actively encouraging their initiatives (Joussemet et al., 2004). In other words, teachers need to take an active role to be able to support autonomy conducive to self-regulation gains. It has been suggested that this kind of interactions is more difficult to implement than interactions that are based on prepared lessons and materials (Stipek et al., 1995). Focused and systematic professional development programs that help adults to accurately read a child's social and emotional cues, and respond to them appropriately within the classroom contexts, can represent a good way to improve teacher's ability to appropriately support child autonomy (Sabol & Pianta, 2012). Notably, although more research is needed, findings from this study call attention to the specific links between features of teacher–child relationships and developmental domains, suggesting that interventions designed to foster both vocabulary and self-regulation skills via relationships should target both relational features.

The implications of our findings are particularly important in the Portuguese context. Previous research conducted in Portugal has shown that children display a great heterogeneity of vocabulary and self-regulation skills in preschool likely to impact their school progress later on, with the family context contributing to this variability (Cadima et al., 2010, 2015). Given the current challenges in the Portuguese educational system, namely the high rates of school dropout (OECD, 2016), findings from this study suggesting that warm and autonomy supportive relationships can be a powerful means to enhance foundational skills during the preschool may be useful in designing early preventive intervention. Considering the particular context in which this study was conducted, it would be interesting for future research to examine the cultural meaning of the different domains of teacher–child relationships by testing cross-cultural models of teacher–child relationship quality, thus enhancing the current understanding of the role of culture in shaping the development of relationships between teachers and children.

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