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Self-Regulation, Engagement, and Developmental Functioning in Preschool-Aged Children

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Abstract

Self-regulation can be relevant for engagement, as children need to be able to modulate behaviors and control attention to be engaged. Although previous studies focus on the relation between self-regulation and engagement, little is known about this subject in children with disabilities or at risk. This study analyzes relations between self-regulation and engagement in inclusive preschool settings, considering children's developmental functioning (DF). The main goal is to examine whether DF moderates the relation between self-regulation and engagement. Participants include three groups of children: with disabilities ($n = 54$), at risk ($n = 78$), and typically developing ($n = 115$). DF was assessed with a short version of the Matrix for Assessment of Activities and Participation; self-regulation with Head-Toes-Knees-Shoulders; and engagement with Child Observation in Preschool. Results indicated that higher levels of self-regulation were related to higher levels of engagement. A moderation effect between self-regulation and DF was also found: in the group of children with disabilities, the influence of self-regulation on engagement was larger. This highlights the relevance of promoting self-regulation, particularly in children with lower DF.

Keywords

self-regulation, engagement, preschool, inclusion, developmental functioning

Introduction

Self-regulation skills are considered a hallmark of successful development, being relevant for children's engagement, academic achievement, school adjustment, and social behavior (Blair & Razza, 2007; Eisenberg et al., 2001; McClelland et al., 2007; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005; Sameroff, 2009; Valiente, Lemery-Chalfant, & Castro, 2007). The presence of early disabilities or risk of developmental delay can have important implications for the development of children's regulatory systems (Crnic, Hoffman, Gaze, & Edelbrock, 2004). However, little is known about self-regulation skills in young children with disabilities or at risk of presenting a developmental delay.

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Self-Regulation in Early Ages

Self-regulation shows rapid growth in early childhood, suggesting that this is a sensitive period for the development of these skills (Diamond, 2002; Kochanska, Coy, & Murray, 2001; McClelland & Cameron, 2012). Self-regulation has been conceptualized in many different ways, but it is commonly defined as a multidimensional construct (Baumeister & Vohs, 2004). This construct partially overlaps with the concept of executive function, which has been considered an umbrella term that includes self-regulation (Zelazo, Blair, & Willoughby, 2016). According to Zelazo and colleagues (2016), these two constructs can be distinguished. While *executive function* refers to a specific set of regulation skills involved in conscious goal-directed action, *self-regulation* refers to the range of ways by which individuals adjust their behavior to environmental demands, which includes intentional executive function and involuntary processes (e.g., Blair, 2002). According to Sameroff (2009), self-regulation is defined as a person's own understanding about the self, the context, and about the ways that the self has to interact with the context to achieve individual goals. It refers to the control of cognitive, emotional, and behavioral processes that lead to positive adjustment, adaptation, and developmental outcomes (Blair, 2002; Diamond, 2002; Sameroff, 2009).

According to a cognitive perspective on self-regulation, adaptive self-regulation skills in preschool-aged children include behaviors such as taking turns in conversations and in play, persisting in activities, and recalling instructions to function in daily contexts (Ponitz et al., 2008). We frame our study within such a cognitive approach to self-regulation in preschool children that considers attention flexibility, working memory, and inhibitory control as important interrelated components for children's participation and success in educational contexts (Best & Miller, 2010; Blair & Razza, 2007; Happaney, Zelazo, & Stuss, 2004; Liew, 2012; McClelland & Cameron, 2012; Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009; Smith-Donald, Raver, Hayes, & Richardson, 2007). Specifically, attention flexibility skills enable children to voluntarily and adequately focus and sustain attention on a task, shift from one task to another, and select some stimuli in the environment while ignoring others that are not relevant for the task (Rothbart & Posner, 2005). Working memory skills allow children to keep information in mind and to process it for an adequate participation in an activity (Gathercole & Pickering, 2000). Inhibitory control refers to children's ability to stop an impulsive response in favor of a more adaptive and adequate one (Dowsett & Livesey, 2000).

Although some studies conceptualize self-regulation as a set of separable cognitive abilities, others argue that in early childhood self-regulation is best described as a unitary, integrative construct that can take different expressions, depending on contextual demands (Fuhs, Wyant, & Day, 2011; Wiebe, Espy, & Charak, 2008; Wiebe et al., 2011; Zhou, Chen, & Main, 2012). Particularly in younger children, there is empirical support for a unitary model of the construct as more adequate for understanding self-regulation (Wiebe et al., 2008). As such, the abovementioned components of cognitive self-regulation, namely, attention flexibility, working memory, and inhibitory control (Zhou et al., 2012), are viewed as highly interrelated in this age group.

By being able to maintain and shift attention adequately, remember information, and control impulsive behaviors, children are more competent at exhibiting developmentally and contextually appropriate behaviors, thus increasing the probability of success in social and learning tasks (Blair & Razza, 2007; Eisenberg, Valiente, & Eggum, 2010; McClelland et al., 2007; Olson et al., 2005; Sameroff, 2009; Valiente et al., 2007). Studies have shown that children who enter kindergarten without adequate self-regulation skills are at higher risk for peer rejection, social maladjustment, and poor academic achievement (Blair, 2002; Gligorović & Durović, 2014). For instance, global regulatory functions at age 4 were found to be significant predictors of social skills 2 years later, and to be partial mediators in the relation between early developmental risk and later social skills (Baker, Fenning, Crnic, Baker, & Blacher, 2007).

The literature also documents that children with early developmental problems are at higher risk for presenting deficits in self-regulation skills, as they show less effective regulation when compared with their typically developing peers (Crnic et al., 2004). Findings also point to a greater variability in the developmental trajectories of self-regulation among young children with developmental delay or at risk of delay.

Engagement in Early Ages

Individual child engagement as observed in everyday activities is a key construct that may help analyze relations between self-regulation and developmental outcomes, thus informing Early Childhood Education and Care (ECEC) and Early Childhood Intervention (ECI) professionals' decisions about interventions in inclusive settings. Engagement is a widely studied concept, particularly in early ages and in educational settings, both in children with and without disabilities (e.g., Grande, 2013; McWilliam & Bailey, 1995; Odom & Bailey, 2001; Pinto, 2006). It has been defined as children's active participation in classroom tasks, activities, or routines (Odom & Bailey, 2001), including developmentally and contextually appropriate interactions with the physical and social environments (Bailey & Wolery, 1992; McWilliam & Bailey, 1992). It is considered a proximal process, as it involves children's interactions with adults, peers, and materials in their immediate development contexts (Downer, Rimm-Kaufman, & Pianta, 2007; Pinto, 2006). Engagement is thought to be an important outcome for children, as several studies show that engagement in natural settings is related to learning and development, both concurrently and longitudinally (e.g., Aydogan, Farran, & Sagsöz, 2015; Chien et al., 2010; Pinto, Barros, Aguiar, Pessanha, & Bairrão, 2006; Williford, Maier, Downer, Pianta, & Howes, 2013; Williford, Whittaker, Vitiello, & Downer, 2013), as well as to gains in school readiness skills (Chien et al., 2010; Williford, Maier, et al., 2013). There is also evidence that children's engagement is related to both child and environmental characteristics (e.g., Aydogan et al., 2015; McWilliam & Casey, 2008). Among child characteristics, developmental status and temperament were found to be associated with engagement (e.g., de Kruif, McWilliam, & Ridley, 2001; Grande & Pinto, 2009; McWilliam & Bailey, 1995; Pinto, 2006), indicating that children with lower developmental status spend more time in lower levels of engagement or nonengaged. Several studies show that self-regulation skills are also important for engagement in educational settings (Cadima, Doumen, Verschueren, & Buyse, 2015; Drake, Belsky, & Fearon, 2014; Fuhs, Farran, & Nesbitt, 2013; Nesbitt, Farran, & Fuhs, 2015; Timmons, Pelletier, & Corter, 2016).

Assessing Children's Developmental Functioning and Engagement in Natural Settings

In accordance with the bioecological model of development (Bronfenbrenner & Morris, 2006), recent approaches to the assessment of children's development maintain that such assessment should be contextualized and not limited to individuals' performance in standardized developmental tasks (Bagnato, Niesworth, & Pretti-Frontczak, 2010; de Sam Lazaro, 2017). Authors argue that standardized testing of capabilities is not sufficient to fully understand child development, and advocate for authentic assessment procedures to document children's functioning in everyday environments. Authentic assessment procedures combine traditional developmental assessments with functionality assessments (Castro & Pinto, 2015; Estabillo, Matson, & Jiang, 2016; Karaaslan & Mahoney, 2015; Martin, 2012; Simeonsson et al., 2003). This is especially relevant in the case of children with atypical developmental trajectories or at risk. Based on evidence and on the World Health Organization (WHO) guidelines (Martin, 2012; Simeonsson et al., 2003; WHO, 2007), current ECI recommended practices highlight the need to develop measures aiming to document

children's functionality. Over the last few years, a growing number of studies on ECI have focused on developing such measures to allow a more comprehensive assessment of children's development within a functionality approach (Castro & Pinto, 2013; Majnemer, 2012). In addition, the authors argue that authentic assessment measures are fundamental to achieve a truly inclusive approach in educational settings, as they provide more accurate information about every child's functioning in daily contexts (Castro & Pinto, 2013; Majnemer, 2012). By focusing on developmental functioning, and by documenting interactive processes such as engagement in natural settings, a more comprehensive understanding of the child can be achieved, above and beyond children's capacities and performance documented by standardized tasks.

Several measures have been developed to assess children's engagement in natural settings. Within an authentic assessment approach, observational measures of engagement during daily activities are commonly used. The most used observational measures include momentary time sampling procedures to capture two aspects of engagement—children's level of engagement and/or amount of time engaged (Kishida & Kemp, 2006; Laevers, 1997; McWilliam & de Kruif, 1998; Wolery, Paucca, Brashers, & Grant, 2000). Both aspects of engagement are considered to be relevant (Downer et al., 2007; Kontos & Keyes, 1999; Raspa, McWilliam, & Ridley, 2001; Wolery et al., 2000). Despite the growing emphasis on engagement, there is still the need to better assess and understand child engagement, specifically for children with disabilities and/or at risk, to design interventions in natural settings (Granlund, 2013; McWilliam & Casey, 2008).

In addition, the need to go beyond children's characteristics in terms of their diagnosis and effectively portray the way children's individual characteristics interact with their preschool environment characteristics to understand how such interactions impact their daily activities is an ongoing work. This can be depicted by considering children's development functioning (Castro & Pinto, 2015; Estabillo et al., 2016; Karaaslan & Mahoney, 2015). Analyzing children's developmental functioning characteristics in relation to their engagement and self-regulation allows us to approach children's development within a more inclusive perspective. More than characterizing children within diagnostic categories, it is important to understand their developmental functioning level to be able to target more functional goals in preschool settings for all children. Such focus on developmental functioning can better capture the dynamic and transactional developmental processes occurring between the individual and the environment (WHO, 2001) and better inform professionals' actions toward all children in inclusive settings.

Self-Regulation and Engagement in Early Ages

Previous studies support that self-regulation may be linked to subsequent children's outcomes and to school achievement through greater engagement with teachers, with peers, and with activities at preschool classrooms (Bohlmann & Downer, 2016; Eisenberg et al., 2010; Nesbitt et al., 2015; Williford, Maier, et al., 2013). In this line, children with poor self-regulation were found to be less engaged with teachers, peers, or classroom tasks and activities (Blair, 2002; Fantuzzo et al., 2007; Nesbitt et al., 2015; Smith-Donald et al., 2007). Results show that both self-regulation skills and engagement in early educational settings are key aspects for child development and learning (Cadima, Doumen, et al., 2015; Drake et al., 2014; Fuhs et al., 2013; Timmons et al., 2016) and engagement in preschool was found to mediate relations between children's self-regulation and academic achievement (Bohlmann & Downer, 2016). Such studies provide evidence of the reciprocal relations between both variables, as self-regulation may impact the development of other skills by either facilitating or hindering children's engagement, which, in turn, is an observable behavior that illustrates children's ability to take advantage of the opportunities and resources afforded by the environments (Blair, 2002; Bohlmann & Downer, 2016).

The idea that children's self-regulation skills are related to child engagement and that children's engagement behaviors in early ages constitute a key mechanism for learning and development

underlines the need for better understanding of relations between self-regulation and engagement to promote all children's development, including those with disabilities or at risk. To our knowledge, the literature exploring relations between self-regulation and engagement was mainly conducted with typically developing children (e.g., Bierman, Torres, Domitrovich, Welsh, & Gest, 2009; Bohlmann & Downer, 2016; Nesbitt et al., 2015; Williford, Whittaker, et al., 2013) leaving aside children with disabilities or presenting low functioning in daily contexts. Taking into account that a certain level of child engagement is required for implementing performance-based self-regulation tasks (Zelazo et al., 2016), children with disabilities and/or at risk may have a higher probability of accumulating difficulties both on engagement levels and on self-regulation skills. Thus, it is relevant to further portray and understand relations between the two concepts in these populations. In addition, most studies on disability and self-regulation in early ages have focused mainly on comparing typically developing children and children with a particular type of disability (e.g., children with intellectual disability, Down syndrome), in particular situations (e.g., dyadic pretend play situations, problem solving using computers) (e.g., Gerstein et al., 2011; Nader-Grosbois & Lefèvre, 2011; Nader-Grosbois, & Vieillevoye, 2012b). Other studies have investigated the relations between poor self-regulation, academic achievement, and behavior problems, without taking into account levels of engagement (e.g., Blair & Razza, 2007; Crnic et al., 2004; Gerstein et al., 2011b).

The Present Study

As previously mentioned, self-regulation indicators (attention, working memory, and inhibitory control) can be relevant for children's functioning in natural contexts, as they reflect ecologically relevant behaviors (McClelland et al., 2014) that are important for engagement in educational settings (Cadima, Doumen, et al., 2015; Drake et al., 2014; Fuhs et al., 2013; Timmons et al., 2016). Self-regulation can be especially relevant for engagement because, to act adequately in everyday activities, children need to be able to modulate their behavior and to control their attention. Although self-regulation and engagement are considered relevant for development, few studies have examined variability in self-regulation in relation to engagement in children with disabilities or at risk aged between 0 and 6 years (Cuskelly, Gilmore, Glenn, & Jobling, 2016; Gerstein et al., 2011; Gligorović & Durović, 2014; Nader-Grosbois & Lefèvre, 2011; Nader-Grosbois & Vieillevoye, 2012).

With the purpose to contribute to the literature on self-regulation in children with disabilities and/or at risk, the present study aims to understand how self-regulation skills may impact a relevant developmental outcome, namely engagement, in inclusive preschool settings. The main goal is to analyze relations between self-regulation and engagement in inclusive preschool settings, exploring whether children's developmental functioning moderates such relationship. More specifically, we intend to understand the extent to which self-regulation is related to engagement in three groups of children with different characteristics in terms of developmental functioning: (a) children with disabilities of different types, (b) at-risk children, and (c) children with typical development. To achieve this main goal, two research questions are addressed.

Research Question 1: To what extent do the three groups of children differ in the levels of self-regulation and engagement?

We expect that children with typical development obtain higher levels of engagement and self-regulation when compared with the other two groups.

Research Question 2: To what extent does the strength of the association between self-regulation and engagement vary as a function of the child's level of developmental functioning?

Table 1. Means (M) and Standard Deviations (SD) for Children's Age, Self-regulation Skills, Levels of Engagement, and Developmental Functioning.

	Groups			
	Children with disabilities (n = 54)	Children at risk (n = 78)	Typically developing children (n = 115)	
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	Scale
Age (months)	53.01 (7.12)	51.67 (6.67)	51.57 (6.97)	
Age range (minimum-maximum)	39-67	36-63	38-64	
Sex (male %)	82	65	52	
Self-regulation	6.53 (10.44)	15.16 (17.47)	30.21 (19.93)	0-60
Engagement level	2.76 (0.47)	2.90 (0.38)	2.97 (0.33)	1-5
Developmental functioning	2.87 (1.07)	3.58 (0.46)	4.79 (0.26)	1-5

We expect that, for the groups of children identified as having disabilities and under risk conditions, the positive correlation between self-regulation and engagement is stronger when compared with the group of children with typical development.

Method

Participants

Participants were 247 preschool-aged children attending 42 classrooms from Porto district, Portugal. Classrooms were selected from the list of preschools registered at the Ministry of Education website in the referred district. Following a random numbers list, school directors were contacted until 42 inclusive preschool classrooms agreed to participate. Overall, 80 ECE institutions were contacted, and 26 did not agree to participate. In addition, 11 institutions were excluded given that they did not meet the criterion to participate in the study: being an inclusive classroom with at least one child eligible for ECI or Special Education (SE) support services attending the classroom.

Participant children included 54 children eligible for SE or ECI support due to disabilities (Portuguese law—DL3/2008 and/or DL281/2009); 78 children considered at risk; and 115 typically developing children. On average, one child with disabilities, two at-risk children, and three typically developing children were selected from each of the 42 classrooms participating in the study. Criterion for selection of the at-risk children and typically developing children are presented in the next section.

The group of children with disabilities presented the following diagnoses: 19 were identified with global developmental delay, 17 were diagnosed with autism spectrum disorder, four were diagnosed with cerebral palsy, two were identified with language delays, two were diagnosed with hyperactivity, and nine were diagnosed with other specific syndromes/conditions—for example, Down syndrome, cardiac condition, Kabuki syndrome, Cri-du-chat syndrome, Costello syndrome. Participant children were aged between 36 and 67 months (M = 51.92 months, SD = 6.88). The three groups of children—with disabilities, at risk, and typically developing—were similar regarding their age, F (2,234) = 38.89, p = .436. However, and similarly to previous studies (e.g., Grande, 2013; Lai, Tseng, Hou, & Guo, 2012), the groups of children with disabilities and at risk included a much higher number of boys than girls (82% and 65%, respectively; see Table 1).

Classrooms had on average 20.98 children (SD = 2.98), including at least one child with disabilities eligible for SE or ECI. The number of children identified as having disabilities per

classroom varied between one and five ($M = 1.63$, $SD = 0.83$). Child/adult ratio varied between 5:1 and 26:1, with an average of 13:1 ($SD = 5.6$). Note that the Portuguese guidelines for inclusive preschool classrooms recommend that each classroom should not have more than two children with identified disabilities attending, with a maximum group size of 20 children when two children with disabilities are attending. Teachers were all females between 27 and 59 years old ($M = 50.04$, $SD = 6.58$). All teachers had at least a degree in preschool teaching, with an average of 16.09 years of formal education ($SD = 0.42$). Their experience as a preschool teacher varied between 2 and 36 years ($M = 25.50$, $SD = 7.13$). Similarly, teachers' experience in inclusive classrooms ranged between 1 and 30 years ($M = 11.66$, $SD = 8.57$).

The Portuguese Data Protection Authority and the Committee for Monitoring Studies in Education Settings of the General Direction of Education Ministry approved all measures and data collection procedures; informed consent was obtained from the preschool directors, preschool teachers, and families.

Instruments

Matrix of assessment of activities and participation (MAAP). The MAAP (Castro, Pinto, & Figueiredo, 2013) measure was used to assess children's developmental functioning. This is a measure designed to assess functionality in accordance with the World Health Organization (WHO, 2007) and guidelines for ECI assessment-intervention processes, in children between 2 and 6 years old. It was developed using the Delphi Method and based on the linkage between commonly used developmental measures (e.g., Griffiths Developmental Scales, Schedule of Growing Skills) and the International Classification of Functioning, Disability and Health—Children and Youth version (ICF-CY; WHO, 2007) codes (Castro, 2012; Castro & Pinto, 2015). The ICF-CY was introduced by the WHO in 2007 as part of the family of international classifications. It derives from the International Classification of Functioning, Disability and Health (ICF) and is defined as a comprehensive classification system that approaches functioning and disability as the result of complex bidirectional interactions between biological, psychological, and social factors, providing a common language to document individuals' functioning in several contexts, including the educational context (WHO, 2007). The ICF-CY system is organized into three main components: body functions and structures, activities and participation, and environmental factors. This classification responds to the need for a universal framework for assessment, intervention, and monitoring of children's progress and outcomes, regardless of their diagnosis (Simeonsson & Lee, 2018). The MAAP items were constructed to portray the contents of developmental measures, which matched the ICF-CY codes and provide profiles of children's functionality in different domains. It has been used previously with typically developing children, children with different types of disabilities, and children at risk (Caetano, 2014; Castro, 2012; Castro & Pinto, 2015). MAAP consists of a questionnaire that can be completed by teachers or other professionals that regularly interact with the child in his or her natural environments. Each item is scored on a scale ranging from 1 (*the child has a total difficulty in the domain described*) to 5 (*the child is totally autonomous in the domain described*). An overall score is obtained by averaging the scores of all items, with higher scores representing higher levels of developmental functionality of the child in the specific context. Authors report good reliability values of the MAAP scores (Cronbach's α between .76 and .98; Castro & Pinto, 2015) and significant differences between the scores of children with disabilities and typically developing children in several dimensions of the measure (Castro & Pinto, 2015).

The short version of the MAAP used in the present study is composed of six items, selected based on the ICF-CY Developmental Code Sets. Such Developmental Code Sets were created through the Delphi Method. This is a widely used and accepted method for gathering data from experts within a specific domain of expertise to achieve convergence of opinion concerning real-world knowledge (Ellingsen, 2011; Hsu & Sandford, 2007). Based on this method, the relevant

ICF-CY codes for assessing developmental functioning of children in the age groups 0 to 2 and 3 to 5 were identified in a study by Ellingsen (2011). The MAAP–short version includes the following items: basic knowledge skills, related to the ICF-CY code d137; ability to perform a single task, related to the ICF-CY code d210; involvement to acquire competencies in preschool tasks and routines, related to the ICF-CY code d815; conversation, related to the ICF-CY code d330; attention, related to the ICF-CY code b140; and play competences, related to the ICF-CY code d880. Cronbach's alpha for the short version of the MAAP obtained in this study was .94, considered a very good value for reliability (Field, 2009).

In this study, the option to use an authentic assessment measure is based on recent approaches in ECEC which highlight the importance of focusing on children's functioning in daily contexts for assessment-intervention processes in *SE* or ECI (e.g., Bagnato et al., 2010; WHO, 2007; de Sam Lazaro, 2017; Majnemer, 2012; Simeonsson et al., 2003). In addition, these authors report that traditional norm-referenced developmental assessments were found to be inadequate or insufficient for children whose development was not following the *normative* path (Bagnato et al., 2010; de Sam Lazaro, 2017; Majnemer, 2012). Literature highlights that norm-referenced assessments tend not to be sensitive to children's disability characteristics (Bagnato, 2007; Macy, Bagnato, Macy, & Salaway, 2015). Based on these assets, we assumed that using a norm-referenced developmental assessment might lead to low variability in the results for the group of children with disabilities and thus would not capture differences in children's functioning in preschool.

Criteria for children's selection in each group. In each classroom, children were selected and categorized into three groups: (a) children with disabilities eligible for SE or ECI services, (b) at-risk children, and (c) typically developing children. For the group of children with disabilities, children were automatically selected as they had been previously identified as eligible for SE or ECI. At least one child with disabilities was selected in each classroom; in 12 classrooms two children with disabilities were selected. For the groups of children at risk and children with typical development, the MAAP–short version scores were used to select for each classroom: two children with the lowest scores in the MAAP–short version in their classroom, for the group at risk; three children randomly selected among the children with the highest scores in the MAAP–short version, for the typically developing group. In each classroom, teachers completed the MAAP–short version for all children whose parents previously agreed to participate in the study and participants were selected among those children.

Head-Toes-Knees-Shoulders (HTKS). HTKS (Ponitz et al., 2008) was used to assess children's self-regulation skills. This is a direct observation measure of children's self-regulation skills: namely, attention, working memory, and inhibitory control skills. It consists of a brief game (McClelland & Cameron, 2012) developed for preschool-aged children (3-5 years old). The tasks include several aspects of self-regulation that are similar to the behaviors required of children in early education settings (for instance, waiting, recalling information, and controlling impulsive behaviors), thus providing an ecological valid assessment (McClelland & Cameron, 2012; Ponitz, McClelland, Matthews, & Morrison, 2009). The measure is organized in two parts, each with 10 items. Each item is coded between 0 and 2, based on the child response (0 is coded when the child fails the task; 1 when the child self-corrects the response; 2 when the child answers correctly). Practice items are included in both parts (six items in part one and four in part two). This measure has been used in several studies that report data validity in different samples (Cadima et al., 2016; Cadima, Gamelas, McClelland, & Peixoto, 2015; MacDonald et al., 2016; McClelland & Cameron, 2012; Wanless et al., 2011). For instance, positive associations between the HTKS performance and children's academic outcomes have been reported in previous studies (e.g., Cadima, Gamelas, et al., 2015; Gestsdottir et al., 2014). In the present study, Cronbach's alpha for HTKS was .91, a value considered very good (Field, 2009).

To ensure reliability before data collection, researchers received an online training and completed a certification test created by the authors of the measure. Researchers achieved over 85% of agreement with a master coder in the certification test.

In addition, considering that HTKS was developed for typically developing children, some adaptations were made for its use with children with disabilities. Two tasks were included previously to applying the HTKS, so that observers could check if children knew the body parts involved, as well as to assess if they understood the task and its instructions. If a child did not understand the task or did not know the body parts implied, HTKS was not applied and data were entered as nonapplicable for the child in question. HTKS training items and extra explanations also provided information on the child's ability to understand the task and were used to make decisions about children's coding on the comprehension of the task. A dummy variable was created: understands the task. When this variable was coded as *no*, data were entered as nonapplicable and children were excluded from the analyses (nine children did not understand the task, eight of whom were from the group of children with disabilities). If children were not interested or refused to do the task, data were entered as missing for HTKS scores and children were excluded from the analyses (13 children were not interested or refused to do the task, seven of whom were from the group of children with disabilities, five from the at-risk group, and one from the typically developing group of children). HTKS had previously been used with children with disabilities and, as recommended by the authors' measure, practice items were included in the measure overall score, considering that the present study included both children with and without disabilities.

Child observation in preschool (COP). COP (Farran & Anthony, 2014) was used to assess children's engagement. This measure consists of an observation system that captures children's behavior in preschool settings, throughout a typical day. It uses a systematic behavior-sampling procedure, known as a "snapshot" procedure, to collect information on (a) children's listening and (b) verbal behaviors, (c) activity setting–schedule, (d) proximity to and (e) interaction state with teacher and peers, (f) activity and task demands, (g) materials and (h) focus of activities, and (i) level of involvement in the activities. Each child is observed for 3 s, after which the observer immediately codes the nine categories. All children must be observed over 20 snapshots, or sweeps, per preschool day. COP has been used in several studies that report its validity in different samples, including typically developing children, children with different identified disabilities, children in need of special support with no identified disabilities, and children from low-income families (e.g., Fuhs et al., 2013; Lillvist, 2010; Luttropp & Granlund, 2010; Nesbitt et al., 2015; Spivak & Farran, 2016).

In the present study, only data from the involvement category is used. This category is coded in a 5-point scale, where 1 means low engagement (e.g., totally out of task, not paying attention to the activity, sitting quietly, fiddling with another child's hair or clothing, eyes not focused on ongoing activity), 2 means medium-low engagement (e.g., looking at teacher and/or material inconsistently, flat affect, looking bored, visible attention going in and out, visible lack of persistence), 3 means medium engagement (e.g., on task, maintaining eye contact with teacher, participating but may briefly look around, although immediately comes back to task), 4 means medium-high engagement (e.g., eager expression, relevant self-talk during tasks, volunteering responses with positive affect, looking at material throughout the entire time; leaning forward, showing persistence), and 5 means high engagement (e.g., intense focus, serious persistence and pursuit of activity, very difficult to be distracted from the activity, seeming oblivious to noise and the behaviors of the other children that are not related to the task). The category score is computed by averaging the values of the 20 observation sweeps for each child. COP scores on the involvement category were significantly and positively correlated with all the MAAP–short version individual items (r ranging between .20 and .28). Among the correlations, the strongest was with the MAAP–short version item related to involvement to acquire competencies in preschool tasks and routines ($r = .28$).

Researchers collecting data received training on the measure, which included theoretical sessions, video coding and discussion, and in-context observation for interobserver agreement reliability. Training included observation of typically developing children and children with diverse disabilities to adequately code all children's engagement, as children with disabilities may present different indicators of engagement (Imms et al., 2017). Overall exact interobserver agreement during training was 94.56%. For reliability purposes during data collection, two researchers observed and independently coded 25.05% of children. The two researchers observed children simultaneously for 3 s and scored the child on all COP dimensions. This was repeated for about 20 sweeps per child during a 3-hr observation period. After independent scoring, the two observers' scores were compared for each observation sweep. Specifically, the involvement category used in the present study obtained an exact interobserver agreement of 80.07%; agreement within one point difference was 98.46%; weighted kappa was .78, showing good reliability.

Procedures

Data collection was conducted between January and May 2016. In each classroom, there were two moments of assessment. First, an individual interview with the teachers was held to complete the MAAP–short version measure. Trained and experienced researchers on the measure met with the teachers to conduct an interview to code the MAAP–short version for all children in the classroom whose parents agreed to participate in the study. This first assessment was used to select the target children in each classroom. Then, a second assessment moment occurred, in which observation cycles with the COP and individual assessments of self-regulation were conducted. The second moment of data collection occurred 2 to 3 weeks after the first assessment moment, in each classroom. The COP measure was completed within a 3-hr period of observation in the classroom during the morning. Observations were conducted by trained researchers. The observation cycles were run sequentially, starting at the beginning of the preschool day (approximately 9 a.m.) and lasting until approximately 12 noon. It included all classroom routines occurring during that period. On average the following routines were observed: whole group activities (approximately 47% of the observation period), centers and small group activities (approximately 24% of the observation period), mealtime, transitions, and playground (approximately 10% of the observation period in each). On average, for each child, engagement was coded in 20.87 sweeps ($SD = 2.17$) across all morning activities. Observations with the COP followed authors' recommendations. Specifically, each observation sweep lasted for 3 s per child. All children being observed in the classroom were coded in a sequence (e.g., child A behavior was observed for 3 s and coded, child B behavior was observed for 3 s and coded, and so on, until all participants were observed; then a new observation cycle/sweep began starting with child A being observed; this was repeated for an average of 20.87 cycles/sweeps). Children's individual assessments of self-regulation skills were conducted during the afternoon, in the same day of observation with the COP measure, in a separate classroom of the preschool context. Each child was assessed individually by a trained observer. It took, on average, 10 min to complete each child assessment of self-regulation skills.

Data Analyses

To examine the associations between self-regulation and engagement across the three groups of children, two sets of analyses were conducted. First, we examined the extent to which the three groups of children differed in engagement and self-regulation, using analysis of variance (ANOVA). Second, generalized linear model (GLM) analyses were performed to examine (a) the main effect of self-regulation in the three groups of children and (b) the moderation effect of self-regulation on engagement according to the group of developmental functioning.

Table 2. Effects of Self-Regulation and Developmental Functioning Group on Engagement.

	Engagement		
	F	*P*	η^2
Sex	5.24	.023	.024
Age	0.29	.059	.001
Developmental functioning group	2.93	.055	.027
Self-regulation	3.95	.048	.019
Developmental functioning group × Self-regulation	3.16	.044	.029

Effect sizes were estimated using the eta squared (η^2) and interpreted according to Cohen's guidelines (Cohen, 1988): $\eta^2 = .01$ indicates a small effect; $\eta^2 = .06$ indicates a medium effect size; and $\eta^2 = .14$ indicates a large effect size.

Results

Before conducting analyses on differences between the three groups on self-regulation and engagement, group differences were explored regarding children's developmental functioning levels. The three groups of children differed in their developmental functioning level. As expected, statistically significant differences between the groups were found for the MAAP–short version global score, $F(2, 243) = 226.194$, $p < .001$, $\eta^2 = 0.65$, indicating that children with typical development obtained higher levels of engagement and self-regulation when compared with the other two groups. Post hoc analyses, specifically Tukey's honestly significant difference (HSD) analyses showed that all pairs were significantly different in the MAAP–short version scores ($p < .001$), thus justifying that further analyses consider these three groups of children.

ANOVA was used to examine differences in engagement, according to developmental functioning group. Results showed that levels of engagement were different across the three groups, $F(2, 244) = 5.44$, $p = .005$, $\eta^2 = .043$. Post hoc analyses, specifically Tukey's HSD, showed that the group with disabilities presented significantly lower levels of engagement than the typical development group ($p = .003$). No significant differences were found between the other two pairs of groups.

ANOVA was also used to examine differences in self-regulation according to developmental functioning group. Results showed that levels of self-regulation also varied across the groups, $F(2, 224) = 32.34$, $p < .001$, $\eta^2 = .224$. Tukey's HSD analyses were conducted, showing that all pairs were significantly different ($p < .05$), with the group with disabilities presenting lower self-regulation average scores ($M = 6.53$, $SD = 10.44$) than the at-risk group ($M = 15.16$, $SD = 17.47$), and the group with typical development ($M = 30.21$, $SD = 19.93$). Differences between the at-risk group and the typical developmental group were also statistically significant, with higher self-regulation scores for the typical developmental group, as expected.

GLM analyses were used further to test the effect of self-regulation on engagement and the extent to which this effect varied in function of the group of developmental functioning, controlling for child age and sex. Results are presented in Table 2. A main effect was found for self-regulation skills, $F(2, 209) = 3.95$, $p = .048$, $\eta^2 = 0.019$. An interaction effect between self-regulation and developmental functioning group was also found, indicating that the effects of self-regulation on engagement varied across groups, $F(2, 209) = 3.16$, $p = .044$, $\eta^2 = 0.029$. More specifically, in the group of children with disabilities, the influence of self-regulation on child engagement was stronger, when compared with the other groups (see Figure 1), indicating that, particularly for children with disabilities, self-regulation skills can present a compensatory effect in children's engagement.

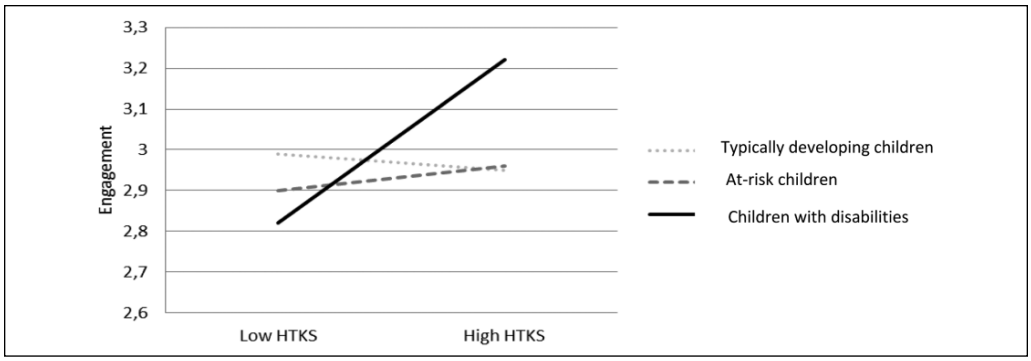

Figure 1. Interaction effect between self-regulation and developmental functioning group on engagement.
Note. HTKS = Head-Toes-Knees-Shoulders scores.

Discussion

The present study aimed to analyze relations between self-regulation and engagement in inclusive preschool settings, by examining whether developmental functioning could moderate the relation between the two variables. Considering such a goal, this study intended to contribute to better understand how self-regulation skills may impact children's engagement, namely in children with disabilities, at-risk children, and typically developing children. Self-regulation and engagement in early ages have been highlighted as core aspects for children to succeed in the daily challenges of their educational settings, as well as for children's future developmental outcomes (Aydogan et al., 2015; Eisenberg et al., 2001; McClelland et al., 2007; Olson et al., 2005). It is thus increasingly relevant to understand the role that both variables play in children with different developmental status. Addressing this need, the present study was designed to analyze relations between self-regulation and engagement in inclusive preschools, considering children with different levels of developmental functioning. The purpose was to understand the role of self-regulation on children's engagement in three groups of children with different developmental functioning characteristics, namely children with disabilities, at-risk children, and typically developing children. Based on previous studies, we expected to find differences between the three groups of children in their levels of engagement and self-regulation skills, as well as a stronger positive relation between these two variables for the group of children with lower developmental functioning.

Overall, our findings showed that self-regulation skills can influence children's engagement. These results are in line with previous research and support the relevance of self-regulation competencies for children's engagement and achievements in educational settings (e.g., Cadima, Doumen, et al., 2015; Drake et al., 2014; Fuhs et al., 2013; McClelland et al., 2007; Sameroff, 2009; Timmons et al., 2016; Williford, Whittaker, et al., 2013). In addition to previous findings, the current results document the relevance of self-regulation competencies and engagement for children's development in early ages, particularly in the case of children with disabilities and children at risk, suggesting that for these children, the two developmental competencies are interrelated. It is known that in the presence of early developmental delay or risk of delay, there is a higher probability for the occurrence of additional difficulties in development, such as behavior problems or psychopathology (Bates, Goodnight, Fite, & Staples, 2009; Crnic et al., 2004). Therefore, this is a group of children with a higher probability of presenting problems in executive skills and regulatory functions (e.g., Gerstein et al., 2011). In fact, results from the present study show that children with disabilities, developmental delays, and/or at risk show

lower engagement levels in classroom activities when compared with typically developing children, and moreover, they demonstrate lower self-regulation skills. It is important to point out that this study included not only children with identified developmental delays but also children with a range of developmental functioning characteristics including children at risk of developmental delay. Our results expand previous literature on the relation among early developmental delay or risk of delay, engagement, and self-regulation competencies (Crnic et al., 2004), by using a functionality approach to identify children who might be at risk. In fact, the group of at risk children, assessed by teachers as having problems in functioning in preschool, presented developmental problems that do not fit official eligibility criteria for referral to services and thus were not receiving additional support in preschool. This result highlights the need for a preventive approach in preschools aiming to preclude such difficulties to escalate and lead to effective developmental delays.

Finally, results from the current study suggest that, in the group of children with disabilities, the influence of self-regulation on engagement was larger, compared with the other groups, thus emphasizing the relevance of these skills for engagement in everyday activities, especially in children with lower developmental functioning. This moderation effect of developmental functioning in the relation between self-regulation and engagement is an important finding and highlights the possibility that children's ability to engage more adequately in the preschool activities can be fostered by promoting their self-regulation skills, namely on children with disabilities.

Implications for Practice

Results have important implications for preschool policies and classroom practices by suggesting the relevance of promoting self-regulation to influence other important developmental outcomes such as engagement.

First, our results point to the need for a preventive approach aiming to identify children at risk of low functioning in preschool environments to preclude early difficulties to escalate. As such, it would be of interest to implement a multitiered system model of support as a framework to design assessment-intervention procedures in preschool, focusing on children's functioning and engagement in daily routines as key dimensions of learning and development (Grisham-Brown & Pretti-Frontczak, 2011; McConnell, Wackerle-Hollman, Roloff, & Rodriguez, 2015). Particularly for children identified as being at risk in the present study, this could be a way to ensure that adequate support was being provided and that children's progresses were being monitored adequately to prevent cumulative incapacitating conditions.

Second, we highlight that our results are in line with recent approaches to disability and risk in ECEC, which convey that interventions should not focus on training specific abilities but, instead, ought to promote transversal and generative competencies (McLaughlin, Snyder, & Hemmeter, 2011; Reynolds & Ou, 2016). Generative competencies are defined as competencies that, when acquired by children, have higher probability to create a chain in the development of additional competencies (McLaughlin et al., 2011). Self-regulation must be considered to be among such generative competencies, as studies show that when children develop such competencies the probability for them to improve their engagement, social skills, and academic skills is increased (e.g., Blair & Razza, 2007; Eisenberg et al., 2001; McClelland et al., 2007; Valiente et al., 2007). Moreover, developing self-regulation competencies within daily routines can be a way to increase children's functioning, as this comprises the way children use their individual and environmental resources to deal with the demands in their natural settings (e.g., Adolfsson, Granlund, & Pless, 2012; Norwich, 2016; WHO, 2001). In fact, our findings suggest that children, particularly those with developmental delays or at risk, can benefit from interventions focusing on promoting generative competencies such as self-regulation within a functional approach, when aiming to enhance children's engagement in natural settings.

Study Limitations

Some limitations to this study need to be acknowledged. First, although a random list of numbers was used in the sampling procedure to select the participating classrooms, some preschools did not answer timely, putting into question a true random selection. Second, the evaluation of children's developmental functioning status was reductive, as it was based solely on teachers' reports of children's functionality in preschool, not including other life settings such as family or community. Third, engagement was assessed based on one dimension. A broader assessment of child engagement could add to the study results. And last, self-regulation skills were assessed via direct measure. Although the measure is robust, other measures, namely teacher and parent reports, would be beneficial to validate further the direct assessment. Besides these measuring issues, we highlight that although the engagement and self-regulation measures used in the present study had been previously applied to children with and without disabilities, they were not initially designed for both populations. These measurement issues were discussed during observer training; however, we are aware of the challenges and limitations of assessing both children with typical development and with diverse disabilities using the same measures, and thus, results must be interpreted carefully.

Future Research

Future studies including a more comprehensive assessment of children's developmental functioning are needed, considering that this might contribute to a more accurate set of results, particularly regarding the medium low developmental functioning group of children at risk. Moreover, it would be relevant to test the moderating effect of other variables, namely classroom characteristics (e.g., adult child ratio, teacher training) and the quality of support services for children with developmental delays, as self-regulation has been previously found to be influenced by teacher interactions (e.g., Cadima, Doumen, et al., 2015). Future research should focus, therefore, on understanding how environmental aspects, namely teacher interactions, can affect the development of regulatory processes in children with developmental delays, thus providing a more dynamic and comprehensive picture of the subject. Such studies could better inform researchers and practitioners on the types of settings through which teacher interaction may potentially foster self-regulation in children with and without disabilities. It would also be of interest to analyze cross-sectional associations, as well as to develop longitudinal studies to better illustrate these processes in early childhood inclusive settings.

In addition, studies combining a performance-based assessment of self-regulation and teacher and/or parent rates could contribute to a better understanding of self-regulation processes in children with disabilities and at risk of developmental delays.

Finally, and considering the implications for practice presented in this article, longitudinal studies are needed that monitor engagement, self-regulation skills, and development in children at risk, and that investigate the role of classroom quality on individual trajectories, to inform decision makers on preschool policies regarding intervention for all children. Furthermore, research on the efficacy of interventions focusing on self-regulation skills in preschool routines for children with disabilities and at risk of developmental delays is still required in this field.

Conclusion

Despite the present study's limitations, our findings contribute to highlighting the relevance of promoting self-regulation skills, particularly in young children with developmental delays, by suggesting that important regulatory processes facilitate these children's engagement in preschool inclusive contexts. In addition, this study provides valuable information to practitioners

by suggesting that when focusing their interventions on the promotion of self-regulation skills they are likely to increase children's ability to get and maintain engagement in classroom daily activities, thus reducing the probability of these children developing additional behavior problems and developmental delays.

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