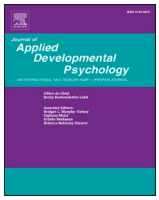
Journal of Applied Developmental Psychology 86 (2023) 101518

Contents lists available at ScienceDirect

Journal of Applied Developmental Psychology

journal homepage: www.elsevier.com/locate/jappdp



Child functioning in inclusive preschools: Associations between self-regulation, engagement, prosociality, and hyperactivity☆

Vera Coelho [a,b,*], Joana Cadima [b,c], Ana Isabel Pinto [b,c,1]

[a] University of Maia- UMAIA Department of Social and Behavioral Sciences, Research Unit in Psychology and Human Development (UNIDEP-UMAIA), Portugal
[b] Center of Psychology of Porto University, Portugal
[c] University of Porto, Faculty of Psychology and Educational Science, Portugal

ARTICLE INFO

Keywords:
Engagement
Hyperactivity
Inclusive preschools
Prosociality
Self-regulation trajectories

ABSTRACT

This longitudinal study examined three groups of children with different levels of developmental functioning who were attending the same inclusive preschool classrooms. It investigated whether gains in self-regulation varied according to developmental functioning and whether the longitudinal associations between self-regulation and later engagement, prosociality, and hyperactivity differed between children with low, medium, and high levels of functioning. Participants comprised 247 preschoolers. Fifty-four were low functioning, 78 were low-medium functioning, and 115 were medium-high functioning. All groups improved their self-regulation over time, though initial levels and growth patterns were different. Children with low-medium functioning showed more accelerated gains than the other groups. Gains in self-regulation were associated with lower hyperactivity and higher engagement in all groups by the end of preschool. Developmental functioning was related to later prosociality and engagement. The results revealed potential differentiated trajectories for children within the same classrooms, highlighting the interdependence of developmental functioning and self-regulation.

Inclusion in Early Childhood Education and Care (ECEC) is a complex process that targets all children (Organization for Economic Cooperation and Development, 2019; Stubbs, 2008; Ebersold, 2015), with current approaches highlighting classroom diversity in terms of variability in children's abilities as inevitable in the scope of human development. It is generally regarded that ECEC creates opportunities to promote all children's participation and increase their functioning and learning outcomes. However, studies have shown that inclusion poses additional challenges in educational settings because teachers have to address a wide range of characteristics while ensuring a high-quality responsive environment for all (Coelho & Pinto, 2018; Pinto et al., 2012).

There is robust evidence showing the lasting effects of readiness skills on later school success (e.g., Duncan et al., 2007). However, studies have also shown a variation in children's competencies at the end of preschool. For instance, children with disabilities or who are at risk (biologically and/or environmentally) are often lower functioning and achieve poorer results in several readiness outcomes during the preschool years (e.g., Karaaslan & Mahoney, 2015). Nevertheless, studies involving children with disabilities have tended to focus on those with more severe issues (e.g., those whose difficulties allow a diagnosis and/or are more evident), with little attention paid to the learning pathways of children with emerging difficulties (and no associated biological and/or environmental risk) and the role of transactional processes that shape their trajectories. Early identification of risk factors for disabilities or poor outcomes during the school years seems to be minimal and/or associated with the presence of severe biological or environmental risk factors; less attention has been given to less evident and severe risk factors or signs of difficulties (e.g., (Goldfeld et al., 2015; Kauffman, Travers, & Badar, 2020; Mensah & Badu-Shayar, 2016). Functioning presents an alternative and promising way to characterize development and has increasingly received theoretical and empirical support (Castro & Pinto, 2015; Karaaslan & Mahoney, 2015). Functioning can be determined for all children, regardless of disability status,

☆ This research was financed by FEDER funds through the Operational Competitiveness Program - COMPETE and by national funds through FCT - Portuguese Foundation for Science and Technology under the reference SFRH/BD/111211/2015; Centre of Psychology of Porto University, Portuguese Foundation for Science and Technology (FCT) under Pluriannual Funding Programme for Research Units 2020-2023 UIDP/00050/2020.

* Corresponding author at: Av. Carlos Oliveira Campos - Castelo da Maia, 4475-690 Maia, Portugal.
E-mail address: vcoelho@umaia.pt (V. Coelho).

[1] Ana Isabel Pinto died in May 2019.

https://doi.org/10.1016/j.appdev.2023.101518
Received 8 March 2021; Received in revised form 13 January 2023; Accepted 5 February 2023

age, or environmental conditions, and has the potential to better capture the diverse abilities of children and their needs within a classroom. Additionally, using the developmental systems frameworks that underline the interrelatedness of preschool outcomes (Fischer & Bidell, 2006; Osher, Cantor, Berg, Steyer, & Rose, 2020), researchers have begun to identify foundational skills that are important for a broad range of developmental domains. Self-regulation has been acknowledged as one such pivotal skill, with several studies linking it with children's learning, adjustment, engagement, and social competencies (e.g., Blair & Razza, 2007; Eisenberg et al., 2001; Lin, Chen, Justice, & Sawyer, 2019; McClelland et al., 2007; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005; Valiente, Lemery-Chalfant, & Castro, 2007; Williford, Whittaker, Vitiello, & Downer, 2013). Self-regulation is commonly defined as a multidimensional construct (Baumeister & Vohs, 2004), and refers to the different ways children adjust their behaviors and emotions to respond to environmental demands and achieve individual goals (Blair, 2002). Although there is robust evidence showing the unique role of self-regulation on early school success, relatively little is known about the longitudinal trajectories of self-regulation in preschool for some children with different levels of functioning. Moreover, it is unclear whether self-regulation in preschool is equally important for all children or whether it is more important for children with low functioning. An understanding of differentiated association between self-regulation and preschool skills might help in the design of early intervention strategies. The present study takes a longitudinal perspective to explore associations between self-regulation skills and important child outcomes such as engagement, prosociality, and hyperactivity, in the context of different levels of functioning within classrooms.

Child functioning: portraying diversity and child development in inclusive settings

Traditionally, when inclusion is being discussed, disability status and risk factors such as biological and/or environmental risk factors, are often described as main sources of variability in educational settings. Additionally, both disability status and risk factors set the conditions for child support in ECEC settings. However, recent studies show that similar patterns of needs can be found among several children, regardless of their diagnoses, disability conditions, or presence of biological/environmental risk factors (Castro, Palikara, & Grande, 2019; Castro & Pinto, 2015; Nilholm & Göransson, 2017; Pinto et al., 2019). In particular, some children who do not have any biological and/or environmental risk factor associated, can present difficulties in responding to educational tasks and challenges. Thus, functional assessments in educational settings enable the identification of children who have a higher risk of presenting lower participation and performance in such settings by approaching child functioning problems per se as an early indicator of risk for difficulties in development and educational inclusion (e.g., Coelho & Pinto, 2018; DeCandia, Volk, Unick, & Donegan, 2020; Martin, 2012; Nave et al., 2009; Simeonsson et al., 2003). Several studies have discussed the need to focus on developmental functioning to better understand children's development in context (e.g., Matheis, Matson, Hong, & Cervantes, 2019; Nave et al., 2009).

Functioning in educational settings has been seen increasingly as a better way of characterizing children's levels of development than diagnostic categories (e.g., World Health Organization, 2007; Simeonsson et al., 2003). This perspective builds on the bioecological and transactional models of development (Bronfenbrenner & Morris, 2006; Sameroff & Fiese, 2000) and highlights the bidirectional influences of individuals and their environment (i.e., physical and social characteristics) on the positive functioning of children with and without disabilities. The concept of developmental functioning does not deny the importance of developmental acquisitions or diagnosis but explains that a typically developing child and a child with some impairment can have similar functioning levels with adequate environmental support and adaptations. Moreover, it can be used to identify children with emerging difficulties and to study the trajectories of those with different skills and needs. In this scope, developmental functioning refers to the form that development takes over time, considering that there are expected developmental stages/acquisition but that every child develops and uses their skills in context in a unique way. Thus, developmental functioning is not solely dependent on the developmental acquisitions but rather on the interaction between environmental factors and child characteristics, underlining the role of environment in hindering or enabling child functioning beyond developmental acquisitions. The concept of developmental functioning emphasizes that functioning and development must be regarded as integrated concepts (e.g., Magnusson & Stattin, 2007; Matheis et al., 2019), an idea that is well aligned with the current developmental systems framework. Both argue that individual-contextual interactions are the key drivers of developmental processes across the life cycle (Cantor, Osher, Berg, Steyer, & Rose, 2019; Osher et al., 2020). In terms of the developmental systems framework, particular attention has been given to childhood experiences and the role of contextual factors, with variability and stability providing relevant information (Cantor et al., 2019). There is a need for a broader perspective in the education and psychology fields, one that takes into account individual variability in children's abilities and needs in inclusive preschools (Luthar, Grossman, & Small, 2015) and combines diagnosis with functional assessments to inform interventions. Researchers must consider a wider range of variables if they are to understand risk and detect nuances in child trajectories.

Functioning and child engagement, prosociality, and hyperactivity

Children's readiness is widely recognized as crucial for later school success (e.g., Duncan et al., 2007). There is robust evidence showing that preschool skills are associated with later performance and adjustment (Duncan et al., 2007; Mashburn & Pianta, 2006; Snow, 2006). School readiness encompasses a broad range of traditional (e.g., language and mathematics) and socioemotional and behavioral domains (La Paro & Pianta, 2000). Indeed, several authors contend that socioemotional, attentional, and behavioral skills are as important as academic/cognitive skills (Blair, 2002; Blair & Raver, 2015)). Particularly when discussing inclusion, the need to go beyond readiness pre-academic skills is stressed even more (e.g., Imms et al., 2017; Sjoman, Granlund, & Almqvist, 2016;). To participate in ECEC settings, all children, regardless of their functioning and developmental status, need to develop a set of core competencies that allow them to take advantage of the opportunities provided by their social and physical environment (e.g., CASEL, 2021; Diakiw, 2016; Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011). Such skills include the ability to engage and complete tasks and develop and maintain positive relationships with peers and adults (e.g., Bayrami & Gordon, 2017; Diakiw, 2016). By contrast, externalizing behaviors, such as hyperactivity and inattention, can increase the risk of negative development, learning, and adjustment. The present study focuses on child engagement, prosocial behaviors, and externalizing behavior issues.

Child engagement refers to appropriate interactions with adults, peers, and/or materials (McWilliam & Bailey, 1995). When children are engaged, they show interest and well-being and are thus more likely to take advantage of the learning opportunities available to them. In educational settings, engagement is positively associated with children's learning and adjustment, both for children with and without disabilities (e.g., Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009). Research shows that engagement can contribute to preventing negative outcomes for children at risk in the early years (e.g., Pears, Kim, Fisher, & Yoerger, 2013) and can explain changes in the trajectories of school-age children considered at risk (due to biological and/environmental factors) and who are developing typically (e.g., Guo, Sun, Breit-Smith, Morrison, & Connor, 2015). Engagement is also highlighted as an overall goal in ECEC because it helps improve children's social and communication

skills, participation, and later school success (Division for Early Childhood & National Association for the Education of Young Children, 2009).

Prosociality refers to children's actions that are intended to interact with and benefit others, including behaviors such as helping, sharing, and comforting others (Denham et al., 2012). These are especially important for children with and without disabilities; research has shown that prosociality can facilitate academic success while minimizing behavioral problems in the classroom in the early years (e.g., Guralnick, 1999; McClelland, Frederick, & Deborah, 2000; McClelland et al., 2007). In inclusive settings, prosociality is also stressed as important for children's participation and inclusion (e.g., Guralnick, Hammond, Neville, & Connor, 2008; World Health Organization, 2013). For children at risk, early social behaviors are considered crucial for development because they help overcome the negative trajectories associated with the presence of risk factors such as low socioeconomic status or maternal education (e.g., Domitrovich, Durlak, Staley, & Weissberg, 2017). Externalizing behavioral problems include inattention, hyperactivity, and impulsive behaviors; they represent the most frequent concerns of professionals related to children's mental health in educational settings (Fauth, Platt, & Parsons, 2017; Graziano et al., 2015). Externalizing behavioral problems in preschool have been linked to poor academic achievement and a greater probability of lower social skills, peer rejection, and poor academic outcomes in elementary school, particularly among children at risk (Kouros, Cummings, & Davies, 2010).

Studies have shown that children with developmental disabilities often present lower levels of engagement (McWilliam & Bailey, 1995) and exhibit less prosociality, thus increasing the risk of negative developmental outcomes (Phillips & Lonigan, 2010), such as behavioral and emotional problems, when compared with children with typical development in ECEC contexts (e.g., Baker et al., 2003; Emerson et al., 2014; Fauth et al., 2017). However, most researchers have taken more traditional approaches, comparing children with specific diagnoses with children without disabilities and without taking into account the greater variability of functioning levels (e.g., considering children with emerging difficulties). It might be best to capture the factors that improve engagement and prosociality and reduce externalizing behavioral problems for different children in ECEC.

Self-regulation in the early years

Self-regulation skills grow rapidly during the early years and continue to grow through the life cycle (Diamond, Stuss, & Knight, 2002; Kochanska, Coy, & Murray, 2001; McClelland & Cameron, 2012). It is now well-established that self-regulation is foundational for children's readiness skills. Children with greater self-regulation skills seem to be more able to adapt to the challenges posed by educational settings, thus contributing to decreased behavioral problems and increasing positive engagement and prosocial behaviors (e.g., Eisenberg, Valiente, & Eggum, 2010; McClelland et al., 2007; Olson et al., 2005; Sawyer, Miller-Lewis, Searle, Sawyer, & Lynch, 2015). Self-regulation skills are strongly related to children's engagement (Bohlmann & Downer, 2016; Eisenberg et al., 2010; Nesbitt, Farran, & Fuhs, 2015; Williford et al., 2013), with studies showing that engagement in preschool mediates relations between children's self-regulation and school achievement (Bohlmann & Downer, 2016).

Self-regulation skills were also found to help children respond to social interactions (Carlson & Wang, 2007). In particular, self-regulation skills were associated with prosocial behavior for children with typical development and children at risk (e.g., Denham et al., 2012). Negative associations between self-regulation skills and children's behavioral problems have also been consistently described in cross-sectional studies (e.g., Rezazadeh, Wilding, & Cornish, 2011) and longitudinal research (e.g., Perry, Calkins, Dollar, Keane, & Shanahan, 2018).

The development of self-regulation begins in infancy, with previous research showing that self-regulation appears to develop at different times and rates, considering the transactional back-and-forth developmental relationships between children's biological characteristics and their contextual experiences (e.g., Chang, Shaw, Dishion, Gardner, & Wilson, 2014; Montroy, Bowles, Skibbe, McClelland, & Morrison, 2016). As such, literature underlines that it is expect that the development of self-regulation in early childhood is likely best represented by a nonlinear function (e.g., Diamond et al., 2002; Montroy et al., 2016). Particularly for children with atypical developmental trajectories (e.g., with disabilities or at risk), and building from the dynamic systems models, this hypothesis that a nonlinear trajectory can better represent self-regulation growth highlights the potential of environmental experiences in shaping children's trajectories. Studies have underlined that children with disabilities often present deficits in the development of their self-regulation because their cognitive systems can be impaired (e.g., Crnic, Hoffman, Gaze, & Edelbrock, 2004; Nader-Grosbois & Vieillevoye, 2012). Children's developmental status can affect self-regulation, thus leading to even greater variability in individual trajectories (Nader-Grosbois & Lefèvre, 2011; Nader-Grosbois & Vieillevoye, 2012). Some studies, including longitudinal ones, have examined self-regulation skills in children with specific types of disabilities (e.g., autism spectrum disorder and Down syndrome; Barnard-Brak, Ivey-Hatz, Ward, & Wei, 2014) and at-risk populations (e.g., low socioeconomic status; Schmitt et al., 2019). However, few studies have examined self-regulation trajectories involving children with varying levels of functioning (e.g., Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000; Castro et al., 2019; Coelho, Cadima, Pinto, & Guimarães, 2019; Davies, Janus, Duku, & Gaskin, 2016; Gagné, Janus, Milbrath, Gadermann, & Guhn, 2018).

Recent studies have suggested that the paths linking self-regulation and readiness may be different for different children (Coelho et al., 2019; Rudasill & Rimm-Kaufman, 2009), so it is important to investigate moderating effects. Building on the pivotal role of self-regulation for children's outcomes, previous studies have shown that self-regulation can moderate the relation between child developmental competencies and the ability to use them in contexts with varying environmental demands (Chandler et al., 2021; Lonigan et al., 2022). For instance, in their study of typically developing preschoolers, Chandler et al. (2021) found that self-regulation moderated the relationship between the child's fine motor skills (developmental) and the ability to write. Self-regulation was particularly important for children with higher levels of fine motor skills when they were completing a challenging writing task and for children with lower fine motor skills for simpler writing tasks. The authors' findings suggested that the effects of fine motor skills on early writing skills varied as a function of levels of self-regulation and the difficulty of the writing task; overall, the authors conclude that self-regulation appeared to compensate for deficits in fine motor skills when children were performing writing tasks. Lengua and Long (2002) study of older children showed that self-regulation mitigated the effects of stress on adjustment problems. A recent study involving children with autism spectrum disorder and attention-deficit/hyperactivity disorder concluded that self-regulation skills were predictive of responses to an intensive behavioral summer treatment program, even after accounting for diagnostic symptoms (Ros and Graziano, 2020). Together, these findings suggest that self-regulation may not only be a foundational skill for child readiness skills but also can counteract the negative influences of low performance in other developmental skills.

We used a developmental systems framework, which considers development as a dynamic process where self-regulation and other developmental skills may compensate for deficits in one or the other skill, to build on the above findings and test whether self-regulation might compensate for the negative influence of functioning on readiness skills (such as engagement, prosociality, and hyperactivity). We hypothesized that high levels of self-regulation would be particularly important for children with low functioning in terms of end-of-preschool outcomes.

The present study

The present study aimed to characterize trajectories of self-regulation and the former's links to other important non-academic readiness skills, such as engagement and prosociality, in three groups of children with different developmental functioning who were attending the same ECEC settings. The abovementioned functioning refers to the form that development takes over time and in context, namely daily behaviors such as interactive behaviors with peers and adults (e.g., playing, using verbal and/or nonverbal language) and objects (e.g., manipulating for achieving a goal), with the recognition that children's abilities are not uniquely dependent on the developmental acquisitions but rather on the interaction between environmental factors and child characteristics (e.g., Magnusson & Stattin, 2007; Matheis et al., 2019). The participants were selected as representative of three levels of child developmental functioning within the same classroom: those with identified disabilities (with a diagnosis and with low functioning) and those without disabilities but with different levels of developmentalfunctioning (i.e., higher and medium-low). This selection was based on the teacher's report on a developmental functioning measure, allowing to select the children with higher values of functioning in this assessment for the high-functioning group, and the children with the lowest values for the medium-low functioning group. The study aimed to analyze: (a) the growth of self-regulation skills in the three groups of children with different developmental functioning; and (b) whether initial and growth levels of self-regulation predicted later child engagement in preschool (as observed and reported by teachers) and prosociality and hyperactivity differently for children in each group. Understanding the extent to which self-regulation skills are important for other child readiness skills can inform interventions aimed at reducing externalizing behavioral problems and improving prosociality and positive engagement. It is globally recognized that to achieve true inclusion in education, classroom diversity must be better understood. The present study was the first step towards a consideration of functioning in addition to diagnoses in educational settings.

Method

Participants

The participants included 247 preschool children ($M_{months} = 46.92$ $SD = 6.71$) attending 42 classrooms (Table 2). Thirty-seven classrooms were public and five were private non-profit. All schools were in the north of Portugal and served preschool-age children (3 to 6 years old). Classrooms from both urban and suburban areas were included. To capture within-classroom variability regarding children's functioning characteristics, three groups were considered: (a) children eligible for early childhood intervention (ECI)/special education (SE) and with low functioning ($n = 54$ at T1); (b) children perceived by teachers as having emerging medium-low functioning difficulties ($n = 78$ at T1); and (c) children perceived by teachers as having higher functioning ($n = 115$ at T1). The teachers assessed child functioning using a short version ($\alpha = 0.94$) of the Matrix for Assessment of Activities and Participation (MAAP; Castro & Pinto, 2015). Under Portuguese law (3/2008), eligible children for ECI/SE in ECEC have low functioning and participation as a consequence of permanent impairments in body functions and/or structures. Thus, in the first group, all children had a diagnosis that impacted functioning in preschool and presented low functioning levels. Children in the low developmental functioning group had varying diagnoses, including global developmental delay ($n = 20$); autism spectrum disorders ($n = 17$); cerebral palsy ($n = 4$); Down syndrome ($n = 3$); language delay ($n = 2$); hyperactivity ($n = 2$); a cardiac condition ($n = 1$); a hearing deficit ($n = 1$); and rare syndromes such as Kabuki, Costello, and Cri-du-chat ($n = 4$). At least one child eligible for SE per classroom was selected for this group. For the second group (the low-medium developmental functioning group), two children who were not eligible for SE additional support and with the lowest scores in the MAAP were selected. For the third group (the medium-high developmental functioning group), the three children with the highest scores in the MAAP were selected. This ensured that children with diverse functioning were selected.

The participants' mothers were, on average, 35.15 ($SD = 5.49$) years of age, with no differences between the three groups of children ($F[2224] = 2.09$, $p = .13$). Their level of education ranged from 3 years of education (lower than elementary school level) to 16 years (higher education level). The average number of years of the mothers' education was 11.04 ($SD = 3.33$). Monthly family income was similar across the three groups ($\chi^2(18) = 27.96$, $p = .06$), with 18.6% of the families having a monthly income between €500 and €750, 15.4% between €750 and €1000; and 21.3% between €1000 and €1250. Those families whose incomes were below the minimum national wage (€500) represented 7.7% of the total, and those over €2000, 9.9%.

The classrooms were all-inclusive. The teachers were all female, with ages ranging between 27 and 59 years old ($M = 50.04$, $SD = 6.58$). All had a higher degree in preschool teaching, with an average of 16.09 years of formal education ($SD = 0.42$). Teaching experience in preschool varied between 2 and 36 years ($M = 25.50$, $SD = 7.13$) and experience in inclusive classrooms, on average, 11.66 years ($SD = 8.57$).

At Time 2 (T2), the overall number of participants dropped from that initially selected at T1. An attrition rate of 20% was registered. No attrition was registered from T2 to Time 3 (T3). Attrition was mainly because: (1) not all the children were attending preschool on T2 and T3 observation days; (2) the children with low developmental functioning had moved to another setting. Observation criteria included the presence of at least 50% of the participating children within the classroom, including at least one child from each group. Thirty-nine classrooms participated at T2 and T3, including 47 children with low developmental functioning, 60 with low-medium developmental functioning, and 91 with medium-high developmental functioning. No significant differences were found for the overall group age ($t(243) = 0.68$, $p = .95$), and sex ($\chi^2(1) = 0.007$, $p = .93$) between the children that continued in the study and those who dropped out.

Procedure

The present study was longitudinal, with three data collection moments across two school years (see Table 1). The study used a multimethod approach, with data being collected both through observation (of children in preschool classrooms), questionnaires (for assessing child functioning engagement in preschool and prosociality and hyperactivity), and direct child assessment (for assessing self-regulation). The Committee for Monitoring Studies in Education Settings of the General Direction of the Ministry of Education and the Portuguese National Data Protection Authority approved the study; informed consent was obtained from teachers and families. Data were collected at three time points (6-monthly). Child engagement was assessed using a multimethod approach (teacher observation and report).

Measures

Developmental functioning

The Matrix of Assessment of Activities and Participation was used to assess the children's developmental functioning. This is a measure designed to assess functionality in accordance with the 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 and Schedule of Growing Skills) and the International Classification of Functioning, Disability, and Health – Children and Youth version (ICF-CY; World Health Organization, 2007) codes (Castro & Pinto, 2015). The MAAP items aim to portray the content of developmental measures; they match the ICF-CY

Table 1
Study variables and study data collection moments.

Variable	Method		Measure[a]	Time-point		
	Observation	Questionnaire		Time 1	Time 2	Time 3
Developmental Functioning		✓	MAAP	✓		
Engagement	✓	✓	COP; CEQ	✓	✓	✓
Self-regulation	✓		HTKS	✓	✓	✓
Hyperactivity behaviors		✓	SDQ	✓		✓
Prosocial behavior		✓	SDQ	✓		✓
Teacher demographics and classroom structural characteristics		✓	SCQ	✓	✓	
Socio-demographic characteristics		✓	FCQ	✓		

[a] MAAP – Matrix for Assessment of Activities and Participation; COP – Child Observation in Preschool; TOP – Teacher Observation in Preschool; CLASS – Classroom Assessing Scoring System; HTKS – Head, Toes, Knees and Shoulders; SDQ – Strengths and Difficulties Questionnaire; CEQ – Child Engagement Questionnaire; SCQ – Structural Characteristics Questionnaire; FCQ – Family Characteristics Questionnaire.

Table 2
Participants age, sex, developmental functioning levels, self-regulation, engagement, prosocial and hyperactivity behavior across the three time points.

			Children with low developmental functioning ($n = 47$)	Children with low-medium developmental functioning ($n = 60$)	Children with medium-high developmental functioning ($n = 91$)
T1		Scale	M *(SD)*	M *(SD)*	M *(SD)*
	Age (months)		46.88 (*6.31*)	46.17 (*6.98*)	40.08 (*7.09*)
	Sex (% male)		82	65	52
	Developmental Functioning	1–5	2.83 (*1.07*)	3.58 (*0.47*)	4.79 (*0.26*)
	Self-regulation	0–60	6.53*(10.44)*	15.16*(17.47)*	30.21*(19.93)*
	Hyperactivity	0–10	6.73*(3.06)*	5.84*(3.12)*	2.44*(2.81)*
	Prosocial	0–10	5.06*(3.05)*	6.89*(2.56)*	8.71*(1.97)*
	Reported Engagement	1–4	2.35*(0.65)*	3.00*(0.55)*	3.56*(0.41)*
	Observed Engagement	1–5	2.76*(0.47)*	2.90*(0.38)*	2.97*(0.33)*
T2					
	Age (months)		53.92 (6.79)	52.73 (6.82)	52.92 (*6.36*)
	Sex (% male)		79	63	54
	Self-regulation	0–60	11.97*(16.78)*	26.08*(19.34)*	40.67*(16.18)*
	Reported Engagement	1–4	2.80*(0.76)*	3.40*(0.44)*	3.81(*0.22)*
	Observed Engagement	1–5	2.75*(0.56)*	3.02*(0.38)*	3.17*(0.40)*
T3					
	Age (months)		59.92 (6.79)	58.73 (6.82)	58.92 (6.36)
	Sex (% male)		79	63	54
	Self-regulation	0–60	19.42*(20.87)*	39.82*(18.04)*	50.58*(10.13)*
	Hyperactivity	0–10	4.87*(3.55)*	2.68*(2.51)*	1.38*(2.03)*
	Prosocial	0–10	6.23*(3.02)*	8.86*(1.32)*	9.70*(0.78)*
	Reported Engagement	1–4	2.61*(0.82)*	3.49*(0.38)*	3.82*(0.23)*
	Observed Engagement	1–5	2.86*(0.52)*	3.05*(0.37)*	*(0.33)*

codes and provide profiles of children's functionality in different domains. This measure has been used with typically developing children, children with different types of disabilities, and children at risk (Castro & Pinto, 2015; Guichard & Grande, 2018). The MAAP can be completed by teachers. 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. There were good reliability values for the MAAP scores (Cronbach's alpha between 0.76 and 0.98; 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 comprises six items based on the ICF-CY developmental code sets: basic knowledge skills; the ability to perform a single task; the acquisition of competencies in preschool tasks and routines; conversation; attention; and play competencies. Cronbach's alpha for the short version of the MAAP in the present study was very good, with a value of 0.94 (Field, 2009)

Self-regulation

Head-Toes-Knees-Shoulders is a direct observation measure focusing on the attention, working memory, and inhibitory control skills of children aged between 3 and 5 years (Ponitz et al., 2008). It comprises 20 items coded between 0 ("When the child fails") and 2 ("When the child answers correctly"). The measure is organized into two parts, plus six practice items in Part 1 and four in Part 2. The measure's validity has been reported in several studies with different samples (Cadima, Gamelas, McClelland, & Peixoto, 2015; Graziano et al., 2015; McClelland & Cameron, 2012; McClelland et al., 2014).

For purposes of reliability, the researchers received online training and completed a certification test, achieving an 85% agreement with a master coder. The HTKS was designed for children with typical development, so adaptations were made to ensure that when children in the low/low-medium developmental functioning group did not understand the task, their scores were entered as non-applicable and excluded from the analysis. Adaptations of the HTKS, following the recommendations of the authors of the measure, included practice items in the overall scoring and two previous tasks, so that observers could check if children knew the body parts involved, as well as to assess whether they understood the task and the instructions. If the child did not understand the task or did not know the body parts, HTKS was not applied, and the data were entered as non-applicable for the child in question. If the children were not interested or refused to do the task, data were entered as missing for HTKS scores and the children were excluded from the analysis. Overall, eight children were excluded; three from the medium-high developmental functioning group and five from the low

developmental functioning group (because they refused to carry out the task). The HTKS had previously been used for children with disabilities and/or at risk and its authors have recommended that the overall score includes practice items to ensure variability. In the present study, Cronbach's alpha for HTKS was good, ranging between 0.83 and 0.96 for the three groups.

Prosocial behavior and hyperactivity

The Strengths and Difficulties Questionnaire (SDQ) is a brief 25-item behavioral screening questionnaire assessing children's specific strengths and difficulties. Each item is scored using a 3-point scale (0 = *not true*, 1 = *somewhat true*, and 2 = *certainly true*). It has a teacher and a parent form and age-related versions and has been widely employed. Several studies have confirmed its adequate psychometric properties and validity (Fauth et al., 2017; Goodman, 2001; Marzocchi et al., 2004; Sjoman et al., 2016). Items are organized in five subscales: Prosocial Behavior, Hyperactivity-Inattention, Emotional Symptoms, Conduct Problems, and Peer Relationships. Scores for each subscale vary between 0 and 10. The present study used the teachers' version. Prosocial Behavior and Hyperactivity-Inattention subscales were examined. Cronbach's alpha for Prosocial Behavior was,0.71 for T1 and 0.88 for T3 for the children with low developmental functioning; 0.74 for T1 and 0.61 for T3 for the children with low-medium developmental functioning; and 0.79 for T1 and 0.30 for T3 for the children with medium-high developmental functioning. Cronbach's alpha for Hyperactivity was 0.78 for T1 and 0.72 for T3 for the children with low developmental functioning s; 0.84 for T1 and 0.60 for T3 for the children with low-medium developmental functioning; and 0.73 for T1 and 0.61 for T3 for the children with medium-high developmental functioning.

Child engagement

The Child Observation in Preschool (COP) captures children's behavior using a systematic behavior sampling procedure (snapshot procedure). It collects information in 9 dimensions: Listening and Verbal Behaviors, To Whom the Child Listens or Talks, Schedule, Proximity, Interaction State, Task, Materials, Focus, and Involvement/engagement. Each child is observed for 3 s, after which all categories are coded. Children in each classroom are observed sequentially. Children must be observed over 20 snapshots per preschool day. In the current study, each child was observed for an average of 20.87 (SD = 2.17) moments across the morning. The validity of COP has been reported in several studies and with different samples, including children with typical development, children with disabilities, and children from low-income families (e.g., Coelho et al., 2021; Lillvist, 2010; Nesbitt et al., 2015).

Categories can be analyzed together or independently. In the present study, only data from the engagement category was examined. This is coded in a 5-point scale, with 1 = *low* engagement (e.g., totally out of task, not paying attention to the activity, sitting quietly, fiddling with another child's hair or clothing, and eyes not focused on the ongoing activity); 2 = *medium-low* engagement (e.g., looking at the teacher and/or material inconsistently, flat affect, looking bored, visible attention going in and out, and visible lack of persistence); 3 = *medium* engagement (e.g., on task, maintaining eye contact with the teacher, participating, briefly looking around, but immediately coming back to task); 4 = *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, and showing persistence); and 5 = *high* engagement (e.g., intense focus, serious persistence and pursuit of activity, very low distractibility, seeming obliviousness to noise and the behaviors of the other children that are not related to the task; see Coelho et al., 2021).

The researchers received theoretical and practical training from the authors of the measure team as part of an international collaboration between the United States, Portugal, and Sweden. The observers were trained to use the measure with materials provided by the U.S. researchers (i.e., the authors of the measure). The researchers' training included video coding and discussion tasks and in-context observation of children with typical development and with different diagnoses. All observers collecting data achieved over 80% exact agreement across all dimensions during the training (Authors, 2021). In the present study, inter-rater reliability was controlled for 25.05% of data collection. For the involvement/engagement category, the exact inter-observer agreement was 74.51% (T2) and 89.37% (T3); agreement within one point was 98.47% (T2) and 95.83% (T3); and weighted kappa was 0.74 (T2) and 0.77 (T3), showing good reliability.

The Child Engagement Questionnaire (CEQ) (McWilliam, 1991) is a 32-item questionnaire rating preschool-aged children's global engagement on a 4-point scale (1 = *not at all typical*, 2 = *somewhat typical*, 3 = *typical*, and 4 = *very typical*). It was designed to be completed by teachers. Items include goal-directed behaviors, persistence behaviors in a challenging task, attention behaviors, and social behaviors. A global score of engagement is obtained by averaging all items. The CEQ has been used previously and its validity reported (e.g., McWilliam, Scarborough, & Kim, 2003; Sjoman et al., 2016). In the present study, the global score of the measure was examined. Cronbach's alpha across the three data collection moments ranged between 0.94 and 0.98 for the children with low developmental functioning; 0.91 and 0.94 for the children with low-medium developmental functioning; 0.85 and 0.93 for the children with medium-high developmental functioning.

Data analysis

Descriptive analyses were conducted to characterize the participant groups regarding the studied variables. Pearson's correlations were computed to examine relations between self-regulation, prosociality, hyperactivity, and the teachers' reports and observations of child engagement. A series of models were tested using MPlus Version 7 ((Muthén and Muthén, 1998-2015)). First, we analyzed the growth in self-regulation skills. Three data collection moments were used to estimate the trajectories for children's self-regulation skills. The characteristics of a trajectory are described by the mean of the intercept (the initial starting point for the trajectory at the first time point) and by the mean of the slope (the rate of change; Preacher, Wichman, MacCallum, & Briggs, 2008). Only children who had data on the three data collection moments were included in the models: that is, 42 children in the low-functioning group, 60 in the low-medium functioning group, and 88 in the medium-high functioning group (cf. attrition data in the participants' section and the number of children that did not complete HTKS in the Measurements section).

We then tested for effects of initial levels of self-regulation (intercept) and growth in self-regulation skills (slope) in several child outcomes, namely: Reported and Observed Engagement, Prosociality, and Hyperactivity at T3. Control variables included previous results on the outcome variable (collected at T1 or T2), as well as the children's sex and age, as these were likely to have impacted self-regulation and behavioral difficulties (e.g., Blair & Razza, 2007; Carlson, Moses, & Breton, 2002; Naerland et al., 2017). For Reported Engagement, Prosociality, and Hyperactivity, we controlled for T1 results. For Observed Engagement, we controlled for T2 results, given this is a variable that is highly affected by the transactions between the child and their environment (McWilliam & Bailey, 1995); what is more, for some classrooms, the physical space and materials available changed from T1 to T2. A separate dummy variable for the group—children with low developmental functioning or children with medium-high developmental functioning (reference group = children with low-medium developmental functioning)—was also included as a predictor in the models to examine differences in paths. Given that several children were attending the same classrooms, the models were estimated using the special feature for complex survey data that is available in Mplus; this addresses the non-independence of observations and prevents biased estimates by correcting the standard errors of the parameters (Muthén and Muthén, 1998-2015). This allowed considering nesting effects. The

fit of each model was assessed based on several indictors, namely, the chi-square likelihood ratio test (χ^2), root mean square error of approximation (RMSEA; good fit is indicated by values ≤0.05; satisfactory fit is indicated by values between 0.05 and 0.08), and the comparative fit index (CFI; good fit is indicated by values ≥0.96; satisfactory fit is indicated by values between 0.90 and 0.95; Hu & Bentler, 1999).

Results

At Time 1 (T1, recruitment moment), all pairs of groups presented significant differences in the MAAP-short-version score (see Table 1): $F(2, 243) = 226.19$, $p < .001$, $\eta^2 = 0.65$. The three groups of children were similar regarding age: $F(2,234) = 38.89$, $p = .44$). Statistical significant differences were also found on the level of developmental functioning level between the three groups at T2 ($F(2,210) = 125.43$, $p < .001$, $\eta^2 = 0.54$) and T3 ($F(2,213) = 129.86$, $p < .001$, $\eta^2 = 0.55$). The group of children with low developmental functioning included a higher number of boys (82% boys with low developmental functioning; 65% of boys with low-medium developmental functioning; 52% boys with medium-high developmental functioning), a trend that has been previously reported (Grande, 2013; Lai, Tseng, Hou, & Guo, 2012). The children with medium-high developmental functioning presented the highest average scores for all variables, except for hyperactivity, for which they scored lowest on average (as was expected). By contrast, children with low developmental functioning presented the lowest scores for all variables except hyperactivity (higher scores, as expected). From T1 to T3, data showed a mean increase in all variables except for hyperactivity scores that decrease, for all groups, thus indicating an improvement in self-regulation, engagement, and prosocial and hyperactivity behaviors.

Correlations between the study variables for each group are presented in Tables 3, 4, 5 and 6. The correlations were moderate and in the expected direction. Particularly in the case of the low developmental functioning group (Table 4), the correlations between self-regulation, hyperactivity and prosociality, and reported and observed engagement, were stronger and more stable across the three moments. For instance, correlations between self-regulation and reported engagement emerged for the three groups of children in T1, but in T3 these variables were only significantly correlated for the low-functioning group of children. For the low-medium developmental functioning group (Table 5), self-regulation at T1 was negatively related to hyperactivity both at T1 and T3 and positively related to prosocial behavior at T3, as well as reported engagement at T2 and T3. The medium-high developmental functioning group (Table 6) presented more modest associations between self-regulation and hyperactivity, prosocial behavior, and reported and observed engagement, though those between self-regulation at T1 and reported engagement both at T1 and T3 should be noted.

Self-regulation trajectories

Overall, the growth model for self-regulation skills showed significant intercept and slope parameters (β = 0.76, SE = 0.12, $p < .001$) and slope (β = 0.93, SE = 0.26, $p < .001$). The model showed good fit: $\chi^2(3) = 0.42$, $p = .94$, CFI = 1.00, RMSEA = 0.00. However, self-regulation initial levels and growth varied according to functioning. The low developmental functioning group presented the lowest levels of initial self-regulation skills (β = −0.21, SE = 0.07, $p = .002$). By contrast, the medium-high developmental functioning group presented higher initial levels of self-regulation (β = 0.42, SE = 0.07, $p < .001$), when compared with the low-medium developmental functioning group. Regarding self-regulation skills, the low developmental functioning and medium-high developmental functioning groups made less gains in self-regulation over time when compared with the low-medium developmental functioning group (β = −0.29, SE = 0.10, $p = .002$ and β = −0.20, SE = 0.09, $p = .029$, respectively). In particular, the low-medium developmental functioning group showed lower initial levels when compared with the medium-high developmental functioning group but improved at an accelerating rate.

Effects of functioning and self-regulation on children's outcomes

Children's engagement

Models examining whether initial levels and growth in self-regulation skills predicted later child engagement in preschool showed that both initial levels and growth in self-regulation were significantly associated with child engagement as reported by teachers (β = 0.34, SE = 0.13, $p = .007$ and β = 0.40, SE = 0.10, $p < .001$, see Fig. 1). The model showed acceptable fit: $\chi^2(8) = 23.05$, $p = .003$, CFI = 0.98, RMSEA = 0.088. Growth in self-regulation was found to be significantly associated with observed engagement ($\beta = 0.37$, $SE = 0.16$, $p = .007$; Fig. 2), but initial self-regulation levels were not (β = 0.05, SE = 0.17, $p = .758$). The model showed acceptable fit: $\chi^2(10) = 18.58$, $p = .046$, CFI = 0.98, RMSEA = 0.058.

The low developmental functioning group showed lower initial (T1)

Table 3
Associations between self-regulation. Engagement. prosociality and hyperactivity. For all participant children.

	1	2	3	4	5	6	7	8	9	10	11	12	13
T1													
	1.Self-regulation	−0.40**	0.30**	0.47**	0.12	0.71**	0.46**	0.16*	0.61**	−0.32**	0.40**	0.49**	0.12
	2.Hyperactivity		−0.53**	−0.57**	−0.22**	−0.42**	−0.57**	−0.24**	−0.37**	0.52**	−0.44**	−0.47**	−0.28**
	3.Prosocial			0.70**	0.27**	0.46**	0.57**	0.37**	0.48**	−0.47**	0.60**	0.60**	0.32**
	4.Reported Engagement				0.34**	0.58**	0.73**	0.34**	0.60**	−0.52**	0.65**	0.75**	0.31**
	5.Observed Engagement					0.28**	0.44**	0.31**	0.27**	−0.22**	0.29**	0.36**	0.26**
T2													
	6.Self-regulation						0.54**	0.19**	0.77**	−0.40**	0.52**	0.61**	0.19*
	7.Reported Engagement							0.44**	0.65**	−0.55**	0.78**	0.8**	0.40**
	8.Observed Engagement								0.32**	−0.24**	0.37**	0.42**	0.51**
T3													
	9.Self-regulation									−0.51**	0.58**	0.79**	0.38**
	10.Hyperactivity										−0.65**	−0.68**	−0.26**
	11.Prosocial											0.83**	0.31**
	12.Reported Engagement												0.40**
	13.Observed Engagement												

* $p < .05$; ** $p < .01$; *** $p < .001$.
Note. N = 198.

Table 4
Associations between self-regulation, engagement, prosociality and hyperactivity, for children with low developmental functioning.

	1	2	3	4	5	6	7	8	9	10	11	12	13
T1													
	1.Self-regulation	−0.19	0.23	0.41*	0.34*	0.75**	0.38*	0.28	0.64**	−0.39*	0.27	0.52**	0.31
	2.Hyperactivity		−0.37**	−0.54**	−0.43**	−0.41*	−0.54**	−0.14	−0.40*	0.58**	−0.38*	−0.47**	−0.17
	3.Prosocial			0.69**	0.33*	0.41*	0.41**	0.28	0.46**	−0.48**	0.57**	0.61**	0.22
	4.Reported Engagement				0.47**	0.62**	0.71**	0.25	0.67**	−0.66**	0.60**	0.80**	0.27
	5.Observed Engagement					0.35*	0.55**	0.48**	0.27	−0.35*	0.35*	0.42**	0.29
T2													
	6.Self-regulation						0.39*	0.26	0.76**	−0.45**	0.35*	0.56**	0.38*
	7.Reported Engagement							0.51**	0.53**	−0.72**	0.75**	0.79**	0.42**
	8.Observed Engagement								0.36*	−0.29*	0.42**	0.41**	0.47**
T3													
	9.Self-regulation									−0.57**	0.43**	0.82**	0.47**
	10.Hyperactivity										−0.67**	−0.77**	−0.42**
	11.Prosocial											0.74**	0.29
	12.Reported Engagement												43**
	13.Observed Engagement												

* $p < .05$; ** $p < .01$; *** $p < .001$.
Note. N = 47.

Table 5
Associations between self-regulation, engagement, prosociality and hyperactivity, for children with low-medium developmental functioning.

	1	2	3	4	5	6	7	8	9	10	11	12	13
T1													
	1.Self-regulation	−0.33**	0.19	0.12	0.13	0.70**	0.36*	−0.12	0.51**	−0.33**	0.41**	0.37**	−0.03
	2.Hyperactivity		−0.29**	−0.28*	−0.04	−0.19	−0.33*	0.16	−0.026	0.32*	−0.30*	−0.20	−0.01
	3.Prosocial			0.60**	0.36**	0.28*	0.33*	0.03	0.191	−0.17	0.39**	0.30*	0.14
	4.Reported Engagement				0.42**	0.17	0.39**	0.01	0.101	−0.05	0.28*	0.34**	−0.04
	5.Observed Engagement					0.34**	0.32*	0.20	0.279*	−0.11	0.25*	0.26*	0.17
T2													
	6.Self-regulation						0.40**	−0.11	0.71**	−0.22	0.40**	0.41**	0.01
	7.Reported Engagement							0.09	0.42**	−0.16	0.55**	0.64**	0.06
	8.Observed Engagement								0.08	0.07	−0.05	0.04	0.42**
T3													
	9.Self-regulation									−0.37**	0.32*	0.55**	0.19
	10.Hyperactivity										−0.34**	−0.40**	0.01
	11.Prosocial											0.67**	0.12
	12.Reported Engagement												0.11
	13.Observed Engagement												

* $p < .05$; ** $p < .01$; *** $p < .001$.
Note. N = 60.

Table 6
Associations between self-regulation, engagement, prosociality and hyperactivity, for children with medium-high developmental functioning.

	1	2	3	4	5	6	7	8	9	10	11	12	13
T1													
	1.Self-regulation	−0.17	0.08	0.36**	−0.01	0.59**	0.15	0.09	0.58**	−0.04	0.09	0.31**	−0.07
	2.Hyperactivity		−0.37**	−0.31**	−0.07	−0.21*	−0.11	−0.25*	−0.09	0.35**	−0.07	−0.07	−0.19
	3.Prosocial			0.36**	−0.07	0.18	0.26*	0.39**	0.04	−0.15	0.19	0.10	0.13
	4.Reported Engagement				−0.06	0.43**	0.21	0.16	0.24*	−0.12	0.19	0.23*	0.02
	5.Observed Engagement					0.16	0.10	0.12	0.10	0.05	−0.08	0.13	0.13
T2													
	6.Self-regulation						0.17	0.09	0.59**	−0.11	0.18	0.33**	−0.04
	7.Reported Engagement							0.18	0.19	0.12	0.22*	0.40**	0.18
	8.Observed Engagement								−0.04	0.04	0.03	0.13	0.45**
T3													
	9.Self-regulation									0.02	0.13	0.44**	−0.01
	10.Hyperactivity										−0.46**	−0.31**	0.12
	11.Prosocial											0.47**	−0.13
	12.Reported Engagement												−0.04
	13.Observed Engagement												

* $p < .05$; ** $p < .01$; *** $p < .001$.
Note. N = 91.

and later (T3) levels of reported engagement when compared with the low-medium developmental functioning group (seeFig. 1). Negative associations of low functioning were found both with self-regulation intercept and slope, which predicted later reported engagement. The medium-high developmental functioning group presented higher levels of initial reported engagement (T1) compared with the low-medium developmental functioning group, but not higher levels of later reported engagement (T3). The children with low-medium developmental

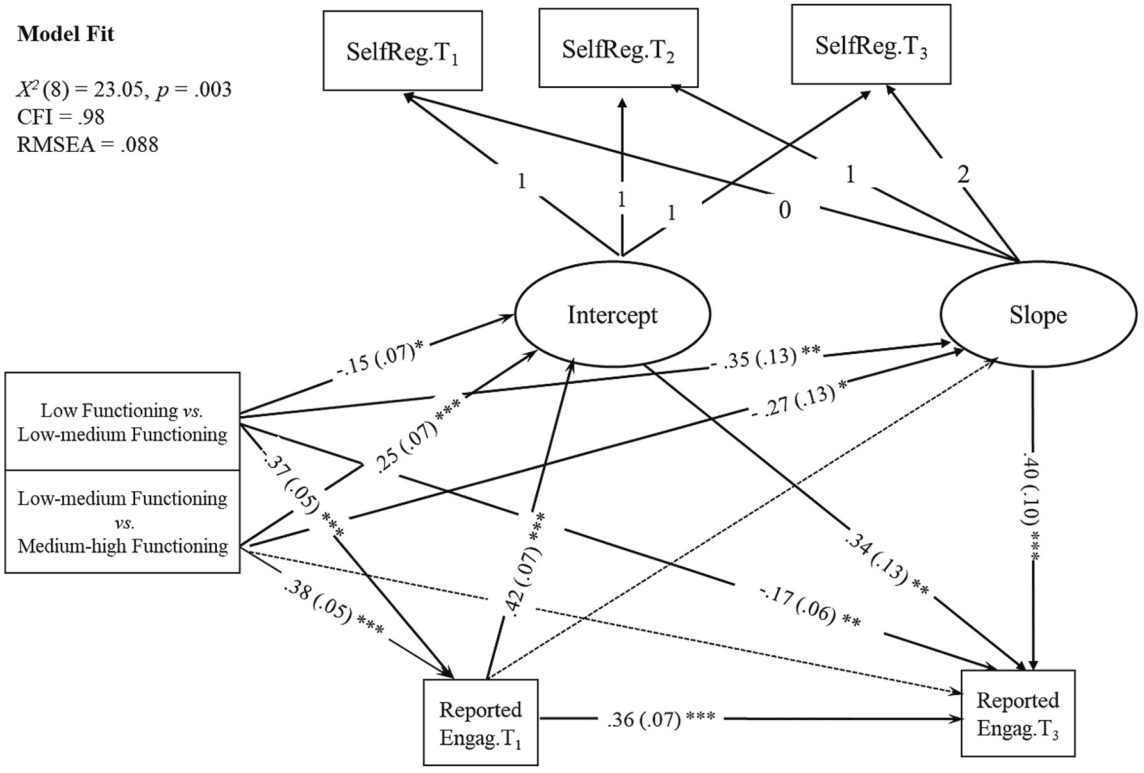


Fig. 1. Effects of Initial Levels and Gains in Self-Regulation on Children's Later Engagement, as Reported by Teachers.

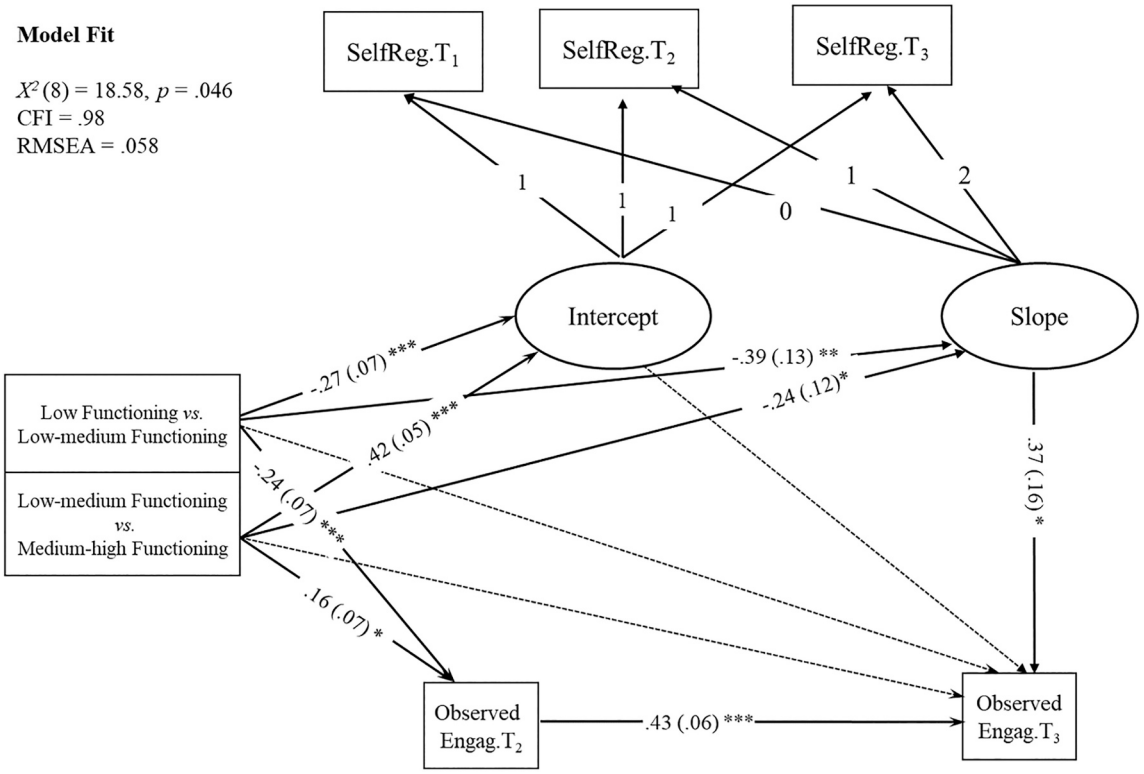


Fig. 2. Effects of Initial Levels and Gains in Self-Regulation on Children's Observed Later Engagement.

functioning showed faster growth in self-regulation skills than those with medium-high developmental functioning, thus contributing to the absence of differences in later reported engagement between the groups.

As with reported engagement, both self-regulation and functioning contributed to the children's later observed engagement (Fig. 2). Differences across groups were, however, less evident. There were no differences in initial and later levels of observed engagement between the children from the low developmental functioning and low-medium

developmental functioning groups. The medium-high developmental functioning group presented higher initial levels of observed engagement compared with the children with low-medium developmental functioning, but no differences were found in later observed engagement.

Prosocial behaviors

Initial self-regulation levels were found to be positively associated (β = 0.43, *SE* = 0.12, $p < .001$) with later prosocial behavior (T3), but self-regulation growth was not (β = 0.08, *SE* = 0.15, $p = .59$; Fig. 3). The model showed acceptable fit: $\chi^2(8) = 20.30$, $p = .01$, CFI = 0.98, RMSEA = 0.079. Moreover, the children with low developmental functioning showed lower initial (T1) and later (T3) levels of pro-social behavior when compared with the children with low-medium developmental functioning. By contrast, the children with medium-high developmental functioning showed higher initial (T1), but not later (T3) prosocial behavior compared with the children with low-medium developmental functioning.

Overall, initial self-regulation predicted later prosocial behaviors, with both functioning and self-regulation skills contributing to improvements in prosocial behavior.

Hyperactivity behaviors

The slope for self-regulation skills predicted hyperactive behaviors (See Fig. 4), but initial status did not (β = −0.35, SE = 0.14, $p = 0.01$. The model showed good fit: $\chi^2(8) = 12.20$, $p = .14$, CFI = 0.99, RMSEA = 0.046. There were no differences in rates of change in hyperactive behavior across child functioning group. Improvement in these skills was not affected by functioning; rather, self-regulation slope was the only variable significantly affecting later hyperactivity levels. The children with medium-high developmental functioning presented lower initial (T1) levels of hyperactivity compared with children with low-medium developmental functioning, but no differences were found between the groups regarding later (T3) hyperactivity levels. Although the children with medium-high developmental functioning showed lower initial levels of hyperactivity compared with those children with low-medium developmental functioning, the differences were not maintained over time.

Discussion

The present study aimed to examine three groups of children with different levels of developmental functioning, attending the same preschool settings. It used a developmental system framework (e.g., Osher et al., 2020) to study children's trajectories of non-academic readiness skills in inclusive settings and to show how developmental functioning affected self-regulation skills growth during the preschool years, as well as the associations between initial and growth levels of self-regulation with later child engagement in preschool (as observed and reported by teachers), hyperactivity, and prosocial behaviors. Models were tested to determine whether the associations differed for children with low developmental functioning, children with low-medium developmental functioning, and children with medium-high developmental functioning, assuming that individual trajectories are shaped across time through interactional processes and that individuals influence each other and are influenced by social and physical contextual factors (Osher et al., 2020). The study examined three groups of children nested within inclusive classrooms because variability in children's abilities within classrooms has been emphasized in discussions on the support of development and learning in inclusive settings (Bartolo, Kyriazopoulou, Björck-Åkesson, & Giné, 2019; Organization for Economic Cooperation and Development, 2019).

Self-regulation trajectories

Overall, our findings indicate that both initial levels and growth of self-regulation are not equal for all children. In the group of children with low developmental functioning, which overlapped with a group of children with identified disabilities in the study, an improvement in self-regulation throughout the preschool years was documented, the rate

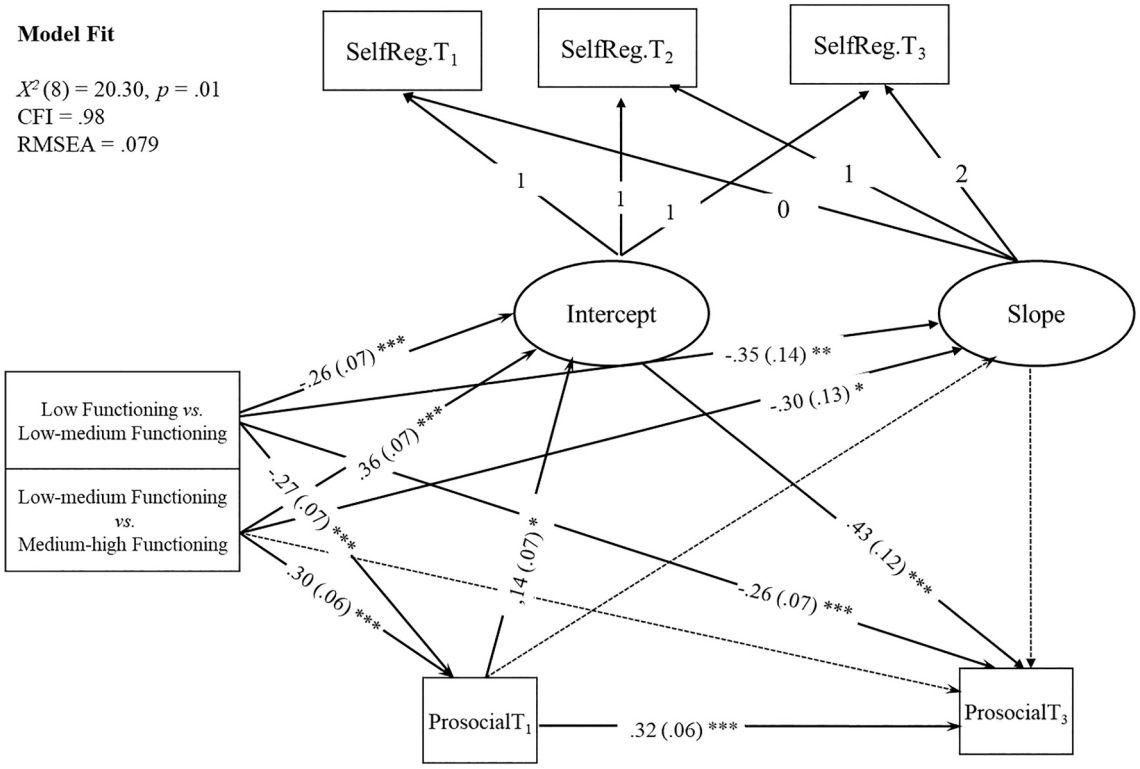


Fig. 3. Effects of Initial Levels and Gains in Self-Regulation on Children's Later Prosociality.

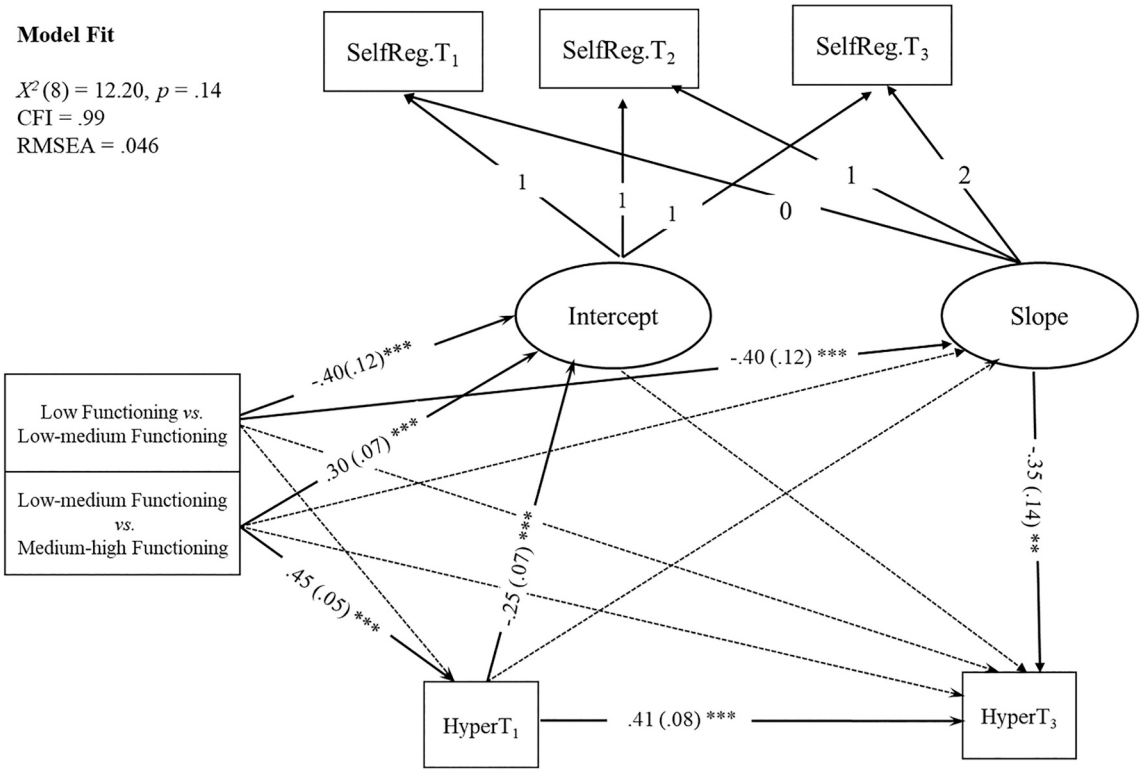


Fig. 4. Effects of Initial Levels and Gains in Self-Regulation on Children's Later Hyperactivity.

was slower than that of peers without disabilities within the same settings. This group had lower initial self-regulation skills as well as lower gains over time. Even though the children showed gains over time, they still lagged behind their sample peers, and the gap increased over time. Our findings, which accord with other studies (e.g., Barnard-Brak et al., 2014; Crnic et al., 2004; Nader-Grosbois & Vieillevoye, 2012), suggest that these children present greater difficulties in the development of self-regulation and may require extra support.

By contrast, children from the low-medium functioning group showed accelerated gains compared with the medium-high functioning group. It appeared that the emerging functioning difficulties that teachers identified at T1, which were associated with lower initial levels of self-regulation and other readiness skills, were no longer relevant at T3. It may be that these children, rather than presenting increasing difficulties in their self-regulation levels over time, were late developers (Montroy et al., 2016) and were able to catch up with the high functioning group.

It is possible that differences between the low-medium and medium-high groups were better described by differences in the timing of the development of self-regulation, with children from the low-medium group developing their skills later, but still catching up with their peers. Previous studies have provided evidence of heterogeneity among children in the developmental trajectories of self-regulation (Montroy et al., 2016). Our findings accord with such studies; they show that the weight of initial levels on the pace of growth can vary. For some children (i.e., the low-functioning group), initial levels seemed to impede greater growth and the gap in self-regulation skills increased over time, whereas other children (i.e., the medium-low functioning group) showed a rapid development in self-regulation, even though they were starting from a lower base.

It seems that the period of early childhood is characterized by a myriad of opportunities and risks, further indicating this period as a rich and important moment for intervention. Early childhood years can be particularly sensitive, with psychobiological or dynamic systems models pointing to the close relationship between children's biological characteristics and their daily experiences.

Effects of functioning and self-regulation on children's outcomes

The present study also aimed to examine the associations between self-regulation and a broad range of outcomes, namely hyperactivity, prosociality, and engagement, and thus focused on relevant non-academic readiness skills that have been previously found to contribute to positive educational pathways (Blair & Raver, 2015; Diakiw, 2016; Grob-Zakhary & Bollington, 2014). What is worth noting is that in the present study, the three groups of children were nested within classrooms, thus ensuring that they were all exposed in equal measure to the same educational environments. Overall, our findings point to the important role of self-regulation. These are in line with literature showing that self-regulation is relevant for the improvement of engagement (e.g., Williford et al., 2013) and prosociality (e.g., Eisenberg et al., 1993; Flook, Goldberg, Pinger, & Davidson, 2015); and the reduction of hyperactivity (e.g., Perry et al., 2018; Rezazadeh et al., 2011). The results also revealed that, as was to be expected, initial levels of self-regulation contributed to certain skill levels (e.g., reported engagement and prosocial behavior), whereas for other skills (e.g., observed engagement and hyperactivity), the rate of growth was a determinant.

In particular, it appeared that gains in self-regulation, regardless of the initial levels, were associated with higher levels of observed engagement and lower levels of hyperactivity for all children. By contrast, initial levels of self-regulation but not growth were associated with prosocial behaviors. It may be that a certain level of self-regulation is needed for self-regulation to have an impact on prosocial behaviors, with increasing gains in self-regulation no longer influencing prosocial skills. It is possible that once children start to utilize self-regulation skills when interacting with other children and develop the ability to attend to and keep track of information and inhibit a dominant negative response, they can exhibit helping, sharing, and comforting behaviors. The results also point to the role played by self-regulation skills on prosocial

behaviors at the early stages, as well as the need to consider additional factors when trying to identify the drivers of children's prosocial competencies.

Differences were found in the paths linking self-regulation and observed and reported engagement. Initial levels of self-regulation were associated with reported engagement but not observed engagement. This may have been due to measurement issues. The measure used relied on a time sampling procedure within an ecological approach. Thus, observed engagement as a transactional outcome was probably affected by situational factors and moment-by-moment fluctuations (e.g., the type of activity and teacher/peer interactions) as well as by the children's momentary dispositions (e.g., preferences, mood, and distress; Bottema-Beutel et al., 2019; Coelho et al., 2021; Farran & Anthony, 2014; Prykanowski, Martinez, Reichow, Conroy, & Huang, 2018). On the other hand, the reported engagement questionnaire relied on teachers' judgment about the child's typical pattern of engagement, thus capturing the teacher's perception of a more stable set of child engagement characteristics or capacities (Bottema-Beutel et al., 2019; Imms et al., 2017). Previous studies have suggested that teacher reports of child engagement often differ from observational data (Pinto et al., 2019). It is nevertheless worth mentioning that gains in self-regulation were associated with both reported and observed engagement, suggesting that growth in self-regulation skills grow was correlated with the children's capacity to maintain engagement beyond the influence of momentary factors.

Regarding functioning levels, the results revealed that for children in the low-medium functioning group, the initial differences exhibited at T1 compared with the medium-high functioning group disappeared at T3, possibly because they were acquiring self-regulation skills at a faster rate. Indeed, the children caught up with their peers in a broad range of outcomes. By contrast, for the low-functioning group, the main differences found at T1 persisted over time. In short, some gaps persisted or even increased, which called our attention to the need for early monitoring and intervention.

Overall, the results revealed that all the groups made gains in self-regulation, which suggests that the children had the potential to improve their skills during the preschool years. Moreover, although different trajectories were documented, self-regulation skills across preschool years were important for several outcomes. The findings illustrate the relevance of inclusive education models that foster the design of universal support measures for all children and align with current perspectives on supporting educational inclusion. As such, the study highlights the importance of designing preschool environments focused on the improvement of self-regulation for all children as a means of preventing later negative outcomes and behavioral difficulties. It is also worth pointing out that improvement in self-regulation skills can be particularly relevant for children with lower functioning (and with disabilities or without) because they can serve as a compensatory factor and help overcome the effects of low functioning.

The level of developmental functioning was used to characterize the children with typical development and those with diverse identified diagnosed disabilities. Some research has shown that lower levels of functioning in natural settings are related to poorer child outcomes (e.g., Karaaslan & Mahoney, 2015), leading to an interest in taking such a perspective to study child trajectories in inclusive settings, going beyond discussions of typical and nontypical developmental trajectories (Cantor et al., 2019), and focusing on the malleability of development through life (Osher et al., 2020). Functioning is a transactional process that combines both the influences of child characteristics and environmental factors. This is aligned with the current developmental systems framework that underlines the interdependence of biological/individual characteristics and environmental (social and/or physical) characteristics in affecting developmental outcomes (Osher et al., 2020). Attention to functioning allows rethinking ECE practices to be better aligned with a development-in-context framework and contributes to a greater understanding of the development of non-academic readiness skills for children with different functioning patterns, including those with identified disabilities.

Implications for practice

It is hoped that the results of the present study might be used to raise professional awareness of inclusive educational settings, the importance of monitoring children's functioning, and developing activities that promote self-regulation skills. This will help improve prosocial behaviors and engagement. Based on their level of developmental functioning in preschool settings, it is possible to identify children who have lower initial self-regulation skills and are thus at greater risk of running into difficulties later on. Therefore, the MAAP measure, or other simple measures focusing on child functioning, can be used to screen children in universal assessment processes implemented by schools. Using information on child functioning can help early education professionals to plan suitable activities and support for all, overcoming traditional ideas that were based primarily on child diagnosis and the presence of biological and/or environmental risk factors. Recent approaches to inclusive education argue that both universal and specialized interventions during the early years should aim to promote transversal and generative competencies (McLaughlin et al., 2011; Reynolds & Ou, 2016) because such competencies increase the probability of creating a chain of development (McLaughlin et al., 2011). Self-regulation must be considered a key competence; when children develop self-regulation, there is a higher probability that they will also develop engagement, social, and academic skills (e.g., Blair & Razza, 2007; Eisenberg et al., 2001; McClelland et al., 2007; Valiente et al., 2007). Thus, early identification of children with lower functioning, as well as early intervention in supporting the development of self-regulation and functioning in preschool settings may help prevent the escalation of problems. Preschools may benefit from a multitiered system model of support when designing assessment-intervention procedures so they focus on functioning and self-regulation in daily routines (Grisham-Brown & Pretti-Frontczak, 2011; McConnell, Wackerle-Hollman, Roloff, & Rodriguez, 2015). Within this model, different types of support and interventions can be based on children's needs and adjusted according to their responses. For instance, the medium-low developmental functioning group of children in the present study was found to show accelerated gains in self-regulation skills during the preschool years, thus indicating that with additional attention, these children could overcome their difficulties more rapidly. When adopting such approaches, professionals would be in a better position to react more appropriately to the variability in children's abilities and their needs within classrooms.

Study limitations and future directions

The present study has several limitations, and these should be considered when the results are being interpreted. First, as we have tried to capture the variability of children's functioning within each classroom, the low-medium developmental functioning group presented a diverse range of characteristics, but social background was not controlled. We are aware that when considering whether a child is at risk (e.g., one from the low-medium developmental functioning group), it is important to consider factors other than level of functioning. More research is needed on how and why teachers perceive some children as having lower functioning and what environmental factors (e.g., family characteristics) and individual factors (e.g., child competencies) are associated with such perceptions. Differences in self-regulation trajectories due to a wide range of both environmental and/or individual variables have been well documented (Hughes & Ensor, 2011; Montroy et al., 2016; Ponitz et al., 2008). Previous studies have shown the importance of family characteristics in children's functioning and development (whether they have disabilities or not), so more accurate estimations of the variables influencing gains in self-regulation are needed. Future researchers might examine the effects of specific family

characteristics on children's self-regulation, prosocial behaviors, and levels of hyperactivity. We also recognize that our criteria for the low-functioning group had their limitations. Although specific diagnoses categories were not used to characterize the children and potential effects related to different diagnoses were not explored, the low-functioning group comprised only those with disabilities. Although this was based on Portuguese law (decree-law 3/2008), we appreciate that the group of children with low functioning/disabilities was automatically selected based on their previous eligibility for support, as determined by the schools' special education teams' assessment. While eligibility was supposed to be based on the assessment of child disability status concerning low participation criteria and the results regarding children functioning levels were based on the teachers' MAAP assessments, cut-off points should be used to organize functioning groups in future studies to improve on traditional approaches to diagnosis. We also note that children's functioning is considered to be a time- and context-dependent and changing variable and that we study did not consider variations in functioning across time and in different contexts. Future studies might address this shortcoming.

Moreover, although it takes a functioning approach to characterize children, the psychometric characteristics of the measure used in the present study need to be further refined, particularly as we used a short version of the original measure and only included aspects of children's functioning in preschool settings. Second, although the study included different diagnostic categories and the level of functioning was considered rather than diagnoses, a high percentage of children with autism spectrum disorders (30%) were included in the group of children with disabilities/low developmental functioning. This might have affected results, as studies have shown that children with this diagnosis have lower social competencies and higher levels of externalizing behavior, which may have accentuated the differences between children at risk and children with disabilities in terms of outcome variables. Thus, future studies should include a more comprehensive assessment of children's developmental functioning and include more variety in categories to balance the effect of particular diagnostic criteria and characteristics on the results. For instance, the group of children with low developmental functioning presented a high standard deviation regarding developmental functioning scores. This may have been related to the severity of some disabilities and influenced our results. Future research including a higher number of children in each diagnostic category is needed to explore further how diagnoses affect functioning scores and, subsequently, findings. These considerations should also be borne in mind when interpreting our results.

The limitations of our measures should also be acknowledged. Although all of them had previously been used with children with and without disabilities, the observers had trained in applying the measures to this population, and a multimethod approach was taken, it is always a challenge to ensure that measures are adequate for all children. For instance, the SDQ reliability was not stable trough time and across groups, especially in the case of the T3 data for children with medium-low functioning. As has been mentioned, this is an understudied group of children; in particular, additional research is needed regarding the psychometric characteristics of measures that are used to examine them. Finally, our results must be interpreted without inferring causal associations. We did not investigate the trajectories of behavioral difficulties and prosociality, as these were only assessed at two time points. Future studies might analyze the positive and negative behavioral trajectories regarding self-regulation during the preschool years among children with diverse functioning.

Conclusion

To the best of our knowledge, the present study is among the first to examine the trajectories of self-regulation among children with different levels of developmental functioning within the same classrooms. Moreover, it brings together three important readiness skills for children's future development and learning — namely, engagement, prosociality, and hyperactivity — to investigate how levels of functioning and self-regulation impact the improvement of such behaviors through the preschool years. The results highlight the relevance of considering the variability in children functioning and self-regulation within each classroom when studying development in context and children's inclusion in the early years. By focusing on groups of children with different functioning attending inclusive preschools, the study provides evidence that the individual develops dynamically and that daily experiences (and their interaction with risk and disability) accelerate such development (Cantor et al., 2019).

Author note

Vera Coelho, University of Maia- UMAIA, Department of Social and Behavioral Sciences, Research Unit in Psychology and Human Development (UNIDEP-UMAIA); Center of Psychology of Porto University, vcoelho@umaia.pt; Joana Cadima' University of Porto, Faculty of Psychology and Educational Sciences, Center of Psychology of Porto University, jcadima@fpce.up.pt; Ana Isabel Pinto, University of Porto, Faculty of Psychology and Educational Sciences, Center of Psychology of Porto University.

Data availability

The authors do not have permission to share data.

References

Baker, B., McIntyre, L., Blacher, J., Crnic, K., Edelbrock, C., & Low, C. (2003). Pre-school children with and without developmental delay: Behaviour problems and parenting stress over time. *Journal of Intellectual Disability Research, 47*(4/5), 217–230. https://doi.org/10.1046/j.1365-2788.2003.00484.x

Barnard-Brak, L., Ivey-Hatz, J., Ward, A. K., & Wei, T. (2014). Self-regulation and social interaction skills among children with autism across time. *Advances in Mental Health and Intellectual Disabilities, 8*(4), 271–279. https://doi.org/10.1108/AMHID-12-2012-0007

Bartolo, P. A., Kyriazopoulou, M., Björck-Åkesson, E., & Giné, C. (2019). An adapted ecosystem model for inclusive early childhood education: A qualitative cross-European study. *International Journal of School and Educational Psychology*. https://doi.org/10.1080/21683603.2019.1637311

Baumeister, R. F., & Vohs, K. D. (2004). *Handbook of self-regulation: Research, theory, and applications*. Guilford Press.

Bayrami, L., & Gordon, M. (2017). Lighting the footpath to a peaceful future: The roots of empathy program. *Exchange, 234*, 8–11.

Blair, C. (2002). School readiness: Integrating cognition and emotion in a neurobiological conceptualization of children's functioning at school entry. *American Psychologist, 57*(2), 111–127. https://doi.org/10.1037/0003-066X.57.2.111.

Blair, C., & Raver, C. C. (2015). School readiness and self-regulation: A developmental psychobiological approach. *Annual Review of Psychology, 66*, 711–731. https://doi.org/10.1146/annurev-psych-010814-015221

Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development, 78*(2), 647–663. https://doi.org/10.1111/j.1467-8624.2007.01019

Bohlmann, N. L., & Downer, J. T. (2016). Self-regulation and task engagement as predictors of emergent language and literacy skills. *Early Education & Development, 27*(1), 18–37. https://doi.org/10.1080/10409289.2015.1046784

Bottema-Beutel, K., Kim, S. Y., Crowley, S., Augustine, A., Kecili-Kaysili, B., Feldman, J., & Woynaroski, T. (2019). The stability of joint engagement states in infant siblings of children with and without ASD: Implications for measurement practices. *Autism Research, 12*(3), 495–504. https://doi.org/10.1002/aur.2068

Brock, L. L., Rimm-Kaufman, S. E., Nathanson, L., & Grimm, K. (2009). The contributions of "hot" and "cool" executive function to children's academic achievement, learning-related behaviors, and engagement in kindergarten. *Early Childhood Research Quarterly, 24*(3), 337–349. https://doi.org/10.1016/j.ecresq.2009.06.001

Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. In W. Damon, & R. M. Lerner (Eds.) (6th ed.,, *Vol. 1. Handbook of child psychology* (pp. 793–828). Wiley.

Cadima, J., Gamelas, A. M., McClelland, M., & Peixoto, C. (2015). Associations between early family risk, children's behavioral regulation, and academic achievement in Portugal. *Early Education & Development, 26*(5/6), 708–728. https://doi.org/10.1080/10409289.2015.1005729

Cantor, P., Osher, D., Berg, J., Steyer, L., & Rose, T. (2019). Malleability, plasticity, and individuality: How children learn and develop in context. *Applied Developmental Science, 23*(4), 307–337. https://doi.org/10.1080/10888691.2017.1398649

Caprara, G. V., Barbaranelli, C., Pastorelli, C., Bandura, A., & Zimbardo, P. G. (2000). Prosocial foundations of children's academic achievement. *Psychological Science, 11*, 302–306. https://doi.org/10.1111/1467-9280.00260

Carlson, S. M., Moses, L. J., & Breton, C. (2002). How specific is the relation between executive function and theory of mind? Contributions of inhibitory control and working memory. *Infant and Child Development, 11*(2), 73–92. https://doi.org/10.1002/icd.298

Carlson, S. M., & Wang, T. S. (2007). Inhibitory control and emotion regulation in preschool children. *Cognitive Development, 22*(4), 489–510. https://doi.org/10.1016/j.cogdev.2007.08.002

CASEL - Collaborative for Academic, Social, and Emotional Learning [CASEL]. (2021). Casel's SEL framework: What are the core competence areas and where are they promoted? https://www.casel.org.

Castro, S., Palikara, O., & Grande, C. (2019). Status quo and inequalities of the statutory provision for young children in England, 40 years on from Warnock. *Frontiers in Education, 4*(76). https://doi.org/10.3389/feduc.2019.00076

Castro, S., & Pinto, A. (2015). Matrix for assessment of activities and participation: Measuring functioning beyond diagnosis in young children with disabilities. *Developmental Neurorehabilitation, 18*(3), 177–189. https://doi.org/10.3109/17518423.2013.806963

Chandler, M. C., Gerde, H. K., Bowles, R. P., McRoy, K. Z., Pontifex, M. B., & Bingham, G. E. (2021). Self-regulation moderates the relationship between fine motor skills and writing in early childhood. *Early Childhood Research Quarterly, 57*, 239–250. https://doi.org/10.1016/j.ecresq.2021.06.010

Chang, H., Shaw, D., Dishion, T., Gardner, F., & Wilson, M. (2014). Direct and indirect effects of the family check-up on self-regulation from toddlerhood to early school-age. *Journal of Abnormal Child Psychology, 42*(7), 1117–1128. https://doi.org/10.1007/s10802-014-9859-8

Coelho, V., Åström, F., Nesbitt, K., Sjoman, M., Farran, D., Bjorck, E., … Pinto, A. I. (2021). Preschool practices in Sweden, Portugal, and the United States. *Early Childhood Research Quarterly, 55*(2021), 79–96. https://doi.org/10.1016/j.ecresq.2020.11.004

Coelho, V., Cadima, J., Pinto, A., & Guimarães, C. (2019). Self-regulation, engagement, and developmental functioning in preschool aged children. *Journal of Early Intervention, 41*(2), 105–124. https://doi.org/10.1177/1053815118810238

Coelho, V., & Pinto, A. I. (2018). The Relationship between children's developmental functioning and participation in social activities in Portuguese inclusive preschool settings. *Frontiers in Education: Special Education Needs*. https://doi.org/10.3389/feduc.2018.00016

Crnic, K., Hoffman, C., Gaze, C., & Edelbrock, C. (2004). Understanding the emergence of behavior problems in young children with developmental delays. *Infants & Young Children, 17*(3), 223–235. https://doi.org/10.1097/00001163-200407000-00004

Davies, S., Janus, M., Duku, E., & Gaskin, A. (2016). Using the early development instrument to examine cognitive and non-cognitive school readiness and elementary student achievement. *Early Childhood Research Quarterly, 35*, 63–75. https://doi.org/10.1016/j.ecresq.2015.10.002

DeCandia, C. J., Volk, K. T., Unick, G. J., & Donegan, L. R. W. (2020). Developing a screening tool for young children using an ecological framework. *Infants and Young Children, 33*(4), 237–258. https://doi.org/10.1097/IYC.0000000000000173

Denham, S. A., Bassett, H. H., Mincic, M. M., Kalb, S. C., Way, E., Wyatt, T., & Segal, Y. (2012). Social emotional learning profiles of preschoolers' early school success: A person-centered approach. *Learning and Individual Differences, 22*, 178–189. https://doi.org/10.1016/j.lindif.2011.05.001

Diakiw, J. (2016). Good for kids, good for us. *Our Schools/Our Selves, 25*(2), 39–46.

Diamond, A., Stuss, D. T., & Knight, R. T. (2002). *Principles of frontal lobe function. Normal development of prefrontal cortex from birth to young adulthood: Cognitive functions, anatomy, and biochemistry* (pp. 466–503).

Division for Early Childhood & National Association for the Education of Young Children. (2009). *Early childhood inclusion: A joint position statement of the division for early childhood and the National Association for the education of young children*. Frank Porter Graham Child Development Institute.

Domitrovich, C., Durlak, J. A., Staley, K. C., & Weissberg, R. P. (2017). Social-emotional competence: An essential factor for promoting positive adjustment and reducing risk in school children. *Child Development, 88*(2), 408–416. https://doi.org/10.1111/cdev.12739

Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., … Japel, C. (2007). School readiness and later achievement. *Developmental Psychology, 43*(6), 1428–1446. https://doi.org/10.1037/0012-1649.43.6.1428.supp

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions. *Child Development, 82*, 405–432. https://doi.org/10.1111/j.1467-8624.2010.01564.x

Ebersold, S. (2015). Accessibilité, politiques inclusives et droit à l'éducation : considérations conceptuelles et méthodologiques. *Alter, 9*(1), 22–33. https://doi.org/10.1016/j.alter.2014.06.001.

Eisenberg, N., Cumberland, A., Spinrad, T. L., Fabes, R. A., Shepard, S. A., Reiser, M., … Guthrie, I. K. (2001). The relations of regulation and emotionality to children's externalizing and internalizing problem behavior. *Child Development, 72*(4), 1112–1134. https://doi.org/10.1111/1467-8624.00337

Eisenberg, N., Valiente, C., & Eggum, N. D. (2010). Self-regulation and school readiness. *Early Education and Development, 21*(5), 681–698. https://doi.org/10.1080/10409289.2010.497451

Emerson, E., Blacher, J., Einfeld, S., Hatton, C., Robertson, J., & Stancliffe, R. J. (2014). Environmental risk factors associated with the persistence of conduct difficulties in children with intellectual disabilities and autistic spectrum disorders. *Research in Developmental Disabilities, 35*(12), 3508–3517. https://doi.org/10.1016/j.ridd.2014.08.039

Farran, D., & Anthony, K. (2014). *Child observation in preschool*. Unpublished manual. Peabody Research Institute.

Fauth, R. C., Platt, L., & Parsons, S. (2017). The development of behavior problems among disabled and non-disabled children in England. *Journal of Applied Developmental Psychology, 52*, 46–58. https://doi.org/10.1016/j.appdev.2017.06.008

Field, A. (2009). *Discovering Statistics Using SPSS* (3rd Edition). London: Sage Publications Ltd.

Fischer, K. W., & Bidell, T. R. (2006). Dynamic development of action, thought, and emotion. In R. M. Lerner (Ed.), *Handbook of child psychology and developmental science: Vol. 1. Theory and method (6th ed., pp. 313–399)*. Wiley.

Flook, L., Goldberg, S. B., Pinger, L., & Davidson, R. J. (2015). Promoting prosocial behavior and self-regulatory skills in preschool children through a mindfulness-based kindness curriculum. *Developmental Psychology, 51*(1), 44–51. https://doi.org/10.1037/a0038256

Gagné, M., Janus, M., Milbrath, C., Gadermann, A., & Guhn, M. (2018). Early emotional and communication functioning predicting the academic trajectories of refugee children in Canada. *Educational Psychology, 38*(8), 1050–1067. https://doi.org/10.1080/01443410.2018.1475627

Goldfeld, S., Woolcock, G., Katz, I., Tanton, R., Brinkman, S., O'Connor, E., … Giles-Corti, B. (2015). Neighbourhood effects influencing early childhood development: Conceptual model and trial measurement methodologies from the kids in communities study. *Social Indicators Research, 120*(1), 197–212. https://doi.org/10.1007/s11205-014-0578-x

Goodman, R. (2001). Psychometric properties of the strengths and difficulties questionnaire. *Journal of the American Academy of Child & Adolescent Psychiatry, 40*(11), 1337–1345. https://doi.org/10.1097/00004583-200111000-00015

Grande, C. (2013). *Estudo do impacto das interacções educadora-criança no envolvimento das crianças com necessidades educativas especiais em contexto de creche e de Jardim-de-infância [study of the impact of teacher-child interactions in the engagement of children with special educational needs in the context of day care and preschool]*. Calouste Gulbenkian Foundation.

Graziano, P. A., Slavec, J., Ros, R., Garb, L., Hart, K., & Garcia, A. (2015). Self-regulation assessment among preschoolers with externalizing behavior problems. *Psychological Assessment, 27*(4), 1337–1348. https://doi.org/10.1037/pas0000113

Grisham-Brown, J., & Pretti-Frontczak, K. (2011). *Assessing young children in inclusive settings: The blended practices approach*. Brookes.

Grob-Zakhary, R., & Bollington, A. (2014). Playing your way to work. *OECD Observer*, 47–48. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=96715771&lang=pt-br&site=ehost-live&scope=site.

Guichard, S., & Grande, C. (2018). Differences between pre-school children with and without special educational needs functioning, participation, and environmental barriers at home and in community settings: An international classification of functioning, disability, and health for children and youth approach. *Frontiers in Education, 3*(7). https://doi.org/10.3389/feduc.2018.00007

Guo, Y., Sun, S., Breit-Smith, A., Morrison, F. J., & Connor, C. M. (2015). Behavioral engagement and reading achievement in elementary-school-age children: A longitudinal cross-lagged analysis. *Journal of Educational Psychology, 107*(2), 332–347. https://doi.org/10.1037/a0037638

Guralnick, M. (1999). The nature and meaning of social integration for young children with mild developmental delays in inclusive settings. *Journal of Early Intervention, 22*(1), 70–86. https://doi.org/10.1177/105381519902200107

Guralnick, M., Hammond, M. A., Neville, B., & Connor, R. T. (2008). The relationship between sources and functions of social support and dimensions of child- and parent-related stress. *Journal of Intellectual Disability Research, 52*(12), 1138–1154. https://doi.org/10.1111/j.1365-2788.2008.01073.x

Hu, L., & Bentler, P. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Hughes, C., & Ensor, R. (2011). Individual differences in growth in executive function across the transition to school predict externalizing and internalizing behaviors and self-perceived academic success at 6 years of age. *Journal of Experimental Child Psychology, 108*, 663–676. https://doi.org/10.1016/j.jecp.2010.06.005

Imms, C., Granlund, M., Wilson, P. H., Steenbergen, B., Rosenbaum, P. L., & Gordon, A. M. (2017). Participation, both a means and an end: A conceptual analysis of processes and outcomes in childhood disability. *Developmental Medicine and Child Neurology, 59*(1). https://doi.org/10.1111/dmcn.13237

Karaaslan, O., & Mahoney, G. (2015). Mediational analyses of the effects of responsive teaching on the developmental functioning of preschool children with disabilities. *Journal of Early Intervention, 37*(4), 286–299. https://doi.org/10.1177/1053815115617294

Kauffman, J. M., Travers, J. C., & Badar, J. (2020). Why Some Students with Severe Disabilities Are Not Placed in General Education. *Research and Practice for Persons with Severe. Disabilities, 45*(1), 28–33.

Kochanska, G., Coy, K. C., & Murray, K. T. (2001). The development of self-regulation in the first four years of life. *Child Development, 72*, 1091–1111. https://doi.org/10.1111/1467-8624.00336

Kouros, C. D., Cummings, E. M., & Davies, P. T. (2010). Early trajectories of interparental conflict and externalizing problems as predictors of social competence in preadolescence. *Development and Psychopathology, 22*(3), 527–537. https://doi.org/10.1017/S0954579410000258.

La Paro, K. M., & Pianta, R. C. (2000). Predicting children's competence in the early school years: A meta-analytic review. *Review of Educational Research, 70*(4), 443–484. https://doi.org/10.3102/00346543070004443

Lai, D., Tseng, Y., Hou, Y., & Guo, H. (2012). Gender and geographic differences in the prevalence of intellectual disability in children: Analysis of data from the national disability registry of Taiwan. *Research in Developmental Disabilities, 33*(6), 2301–2307. https://doi.org/10.1016/j.ridd.2012.07.001

Lengua, L. J., & Long, A. C. (2002). The role of emotionality and self-regulation in the appraisal–coping process: Tests of direct and moderating effects. *Journal of Applied Developmental Psychology, 23*(4), 471–493. https://doi.org/10.1016/S0193-3973(02)00129-6

Lillvist, A. (2010). Observations of social competence of children in need of special support based on traditional disability categories versus a functional approach. *Early Child Development and Care, 180*(9), 1129–1142. https://doi.org/10.1080/03004430902830297

Lin, T., Chen, J., Justice, L. M., & Sawyer, B. (2019). Peer interactions in preschool inclusive classrooms: The roles of pragmatic language and self-regulation. *Exceptional Children*. https://doi.org/10.1177/0014402919828364

Lonigan, C. J., Hand, E. D., Spiegel, J. A., Morris, B. M., Jungersen, C. M., Alfonso, S. V., & Phillips, B. M. (2022). Does preschool children's self-regulation moderate the impacts of instructional activities? Evidence from a randomized intervention study. *Journal of Experimental Child Psychology, 216*. https://doi.org/10.1016/j.jecp.2021.105321

Luthar, S. S., Grossman, E. J., & Small, P. J. (2015). In M. E. Lamb, & R. M. Lerner (Eds.) (7th ed.,*Handbook of child psychology and developmental science: Socioemotional processes* (7th ed.,, *3* pp. 247–286). John Wiley & Sons, Inc https://doi.org/10.1002/9781118963418.childpsy307.

Magnusson, D., & Stattin, H. (2007). The person in context: A holistic-interactionistic approach. In R. Lerner (Ed.), *Handbook of child psychology* (6th ed., pp. 400–464). Wiley & Sons.

Martin, D. (2012). *What is a functional assessment?* Alberta Council of Disability Services. www.acds.ca/web/images/webpages/products/What_is_a_functional_assessment_printable_format.pdf.

Marzocchi, G. M., Capron, C., Pietro, M., Tauleria, E. D., Duyme, M., Frigerio, A., … Thérond, C. (2004). The use of the strengths and difficulties questionnaire (SDQ) in southern European countries. *European Child & Adolescent Psychiatry*. https://doi.org/10.1007/s00787-004-2007-1

Mashburn, A. J., & Pianta, R. C. (2006). Social relationships and school readiness. *Early Education and Development, 17*(1), 151–176. https://doi.org/10.1207/s15566935eed1701_7

Matheis, M., Matson, J. L., Hong, E., & Cervantes, P. E. (2019). Gender differences and similarities: Autism symptomatology and developmental functioning in young children. *Journal of Autism and Developmental Disorders, 49*(3), 1219–1231. https://doi.org/10.1007/s10803-018-3819-z

McClelland, Megan M., Frederick, J. Morrison, & Deborah, L. Holmes (2000). Children at Risk for Early Academic Problems: The Role of Learning-Related Social Skills. *Early Childhood Research Quarterly, 15*(3), 307–329. https://doi.org/10.1016/S0885-2006(00)00069-7

McClelland, M. M., & Cameron, C. E. (2012). Self-regulation in early childhood: Improving conceptual clarity and developing ecologically valid measures. *Child Development Perspectives, 6*(2), 136–142. https://doi.org/10.1111/j.1750-8606.2011.00191.x

McClelland, M. M., Cameron, C. E., Connor, C. M., Farris, C. L., Jewkes, A. M., & Morrison, F. J. (2007). Links between behavioral regulation and preschoolers' literacy, vocabulary, and math skills. *Developmental Psychology, 43*(4), 947–959. https://doi.org/10.1037/0012-1649.43.4.947

McClelland, M. M., Cameron, C. E., Duncan, R., Bowles, R. P., Acock, A. C., Miao, A., & Pratt, M. E. (2014). Predictors of early growth in academic achievement: The head-toes-knees-shoulders task. *Frontiers in Psychology, 5599*. https://doi.org/10.3389/fpsyg.2014.00599

McConnell, S. R., Wackerle-Hollman, A. K., Roloff, T. A., & Rodriguez, M. (2015). Designing a measurement framework for response to intervention in early childhood programs. *Journal of Early Intervention, 36*, 263–280. https://doi.org/10.1177/1053815115578559

McWilliam, R. (1991). *Children's engagement questionnaire*. Frank Porter Graham Child Development Center. Unpublished instrument.

McWilliam, R. A., & Bailey, D. B. (1995). Effects of classroom social structure and disability on engagement. *Topics in Early Childhood Special Education, 15*(2), 123.

McWilliam, R. A., Scarborough, A. A., & Kim, H. (2003). Adult interactions and child engagement. *Early Education and Development, 14*(1), 7–27. https://doi.org/10.1207/s15566935eed1401_2

Mensah, F. A., & Badu-Shayar, J. (2016). Identification of Special Educational Needs for Early Childhood Inclusive Education in Ghana. *Journal of Education and Practice, 7*(11), 1–8.

Montroy, J. J., Bowles, R. P., Skibbe, L. E., McClelland, M. M., & Morrison, F. J. (2016). The development of self-regulation across early childhood. *Developmental Psychology, 52*(11), 1744–1762. https://doi.org/10.1037/dev0000159.supp

Muthén, L. K., & Muthén, B. O. (1998-2015). *Mplus user's guide* (7th ed.). Muthén & Muthén.

Nader-Grosbois, N., & Lefèvre, N. (2011). Self-regulation and performance in problem-solving using physical materials or computers in children with intellectual disability. *Research in Developmental Disabilities, 32*(5), 1492–1505. https://doi.org/10.1016/j.ridd.2011.01.020

Nader-Grosbois, N., & Vieillevoye, S. (2012). Variability of self-regulatory strategies in children with intellectual disability and children with typical development in pretend play situations. *Journal of Intellectual Disability Research, 56*(2), 140–156. https://doi.org/10.1111/j.1365-2788.2011.01443.x

Nave, G., Nishioka, V., Burke, A., & Regional Educational Laboratory Northwest (ED). (2009). Analysis of the developmental functioning of early intervention and early childhood special education populations in Oregon. In *Issues & answers. REL 2009–078*. Regional Educational Laboratory Northwest.

Nesbitt, K., Farran, D., & Fuhs, M. W. (2015). Executive function skills and academic achievement gains in prekindergarten: Contributions of learning-related behaviors. *Developmental Psychology, 51*(7), 865–878. https://doi.org/10.1037/dev0000021

Nilholm, C., & Göransson, K. (2017). What is meant by inclusion? An analysis of European and North American. *European Journal of Special Needs Education, 32*(3), 437–451. https://doi.org/10.1080/08856257.2017.1295638

Olson, S. L., Sameroff, A. J., Kerr, D. C. R., Lopez, N., & Wellman, H. M. (2005). Developmental foundations of externalizing problems in young children: The role of effortful control. *Development and Psychopathology, 17*, 25–45. https://doi.org/10.1017/S0954579405050029

Organization for Economic Cooperation and Development. (2019). TALIS 2018 results (volume I): Teachers and school leaders as lifelong learners. *OECD Publishing*. https://doi.org/10.1787/1d0bc92a-en

Osher, D., Cantor, P., Berg, J., Steyer, L., & Rose, T. (2020). Drivers of human development: How relationships and context shape learning and development1. *Applied Developmental Science, 24*(1), 6–36. https://doi.org/10.1080/10888691.2017.1398650

Pears, K. C., Kim, H. K., Fisher, P. A., & Yoerger, K. (2013). Early school engagement and late elementary outcomes for maltreated children in foster care. *Developmental Psychology, 49*(12), 2201–2211. https://doi.org/10.1037/a0032218

Perry, N. B., Calkins, S. D., Dollar, J. M., Keane, S. P., & Shanahan, L. (2018). Self-regulation as a predictor of patterns of change in externalizing behaviors from infancy to adolescence. *Development and Psychopathology, 30*(2), 497–510. https://doi.org/10.1017/S0954579417000992

Phillips, B. M., & Lonigan, C. J. (2010). Child and informant influences on behavioral ratings of preschool children. *Psychology in the Schools, 47*(4), 374–390. https://doi.org/10.1002/pits.20476

Pinto, A. I., Grande, C., Aguiar, C., de Almeida, Felgueiras, I., … Lopes-dos-Santos, P. (2012). Early childhood intervention in Portugal: An overview based on the Developmental Systems Model. *Infants & Young Children, 25*(4), 310–322. https://doi.org/10.1097/IYC.0b013e3182673e2b.

Pinto, A. I., Grande, C., Coelho, V., Castro, S., Granlund, M., & Björck-Åkesson, E. (2019). Beyond diagnosis: The relevance of social interactions for participation in inclusive preschool settings. *Developmental Neurorehabilitation, 22*(6), 390–399. https://doi.org/10.1080/17518423.2018.1526225

Ponitz, C. C., McClelland, M. M., Jewkes, A. M., Connor, C. M., Farris, C. L., & Morrison, F. J. (2008). Touch your toes! Developing a direct measure of behavioral regulation in early childhood. *Early Childhood Research Quarterly, 23*, 141–158. https://doi.org/10.1016/j.ecresq.2007.01.004

Preacher, K. J., Wichman, A. L., MacCallum, R. C., & Briggs, N. E. (2008). Quantitative applications in the social sciences: Latent growth curve modeling. *SAGE Publications*. https://doi.org/10.4135/9781412984737

Prykanowski, D. A., Martinez, J. R., Reichow, B., Conroy, M. A., & Huang, K. (2018). Brief report: Measurement of young children's engagement and problem behavior in early childhood settings. *Behavioral Disorders, 44*(1), 53–62. https://doi.org/10.1177/0198742918779793

Rezazadeh, S. M., Wilding, J., & Cornish, K. (2011). The relationship between measures of cognitive attention and behavioral ratings of attention in children with typical development. *Child Neuropsychology, 17*(2), 197–208. https://doi.org/10.1080/09297049.2010.532203

Ros, R., & Graziano, P. A. (2020). A transdiagnostic examination of self-regulation: Comparisons across preschoolers with ASD, ADHD, and typically developing children. *Journal of Clinical Child & Adolescent Psychology, 49*(4), 493–508. https://doi.org/10.1080/15374416.2019.1591280

Rudasill, K. M., & Rimm-Kaufman, S. E. (2009). Teacher–child relationship quality: The roles of child temperament and teacher–child interactions. *Early Childhood Research Quarterly, 24*(2), 107–120. https://doi.org/10.1016/j.ecresq.2008.12.003

Sameroff, A. J., & Fiese, B. H. (2000). Models of development and developmental risk. In C. H. Zeanah, Jr. (Ed.), *Handbook of infant mental health* (pp. 3–19). Guilford Press.

Sawyer, A. C. P., Miller-Lewis, L. R., Searle, A. K., Sawyer, M. G., & Lynch, J. W. (2015). Is greater improvement in early self-regulation associated with fewer behavioral problems later in childhood? *Developmental Psychology, 51*(12), 1740–1755. https://doi.org/10.1037/a0039829

Schmitt, S. A., Korucu, I., Purpura, D. J., Whiteman, S., Zhang, C., & Yang, F. (2019). Exploring cross-cultural variations in the development of executive function for preschoolers from low and high socioeconomic families. *International Journal of Behavioral Development, 43*(3), 212–220. https://doi.org/10.1177/0165025418785469

Simeonsson, R. J., Leonardi, M., Lollar, D., Bjorck-Akesson, E., Hollenweger, J., & Martinuzzi, A. (2003). Applying the international classification of functioning, disability and health to measure childhood disability. *Disability and Rehabilitation, 25*(11–12), 602–610. https://doi.org/10.1080/09638280310000

Sjoman, M., Granlund, M., & Almqvist, L. (2016). Interaction processes as a mediating factor between children's externalized behaviour difficulties and engagement in preschool. *Early Child Development and Care, 186*(10), 1649–1663. https://doi.org/10.1080/03004430.2015.1121251

Snow, C. E. (2006). What counts as literacy in early childhood? In K. McCartney, & D. Phillips (Eds.), *Blackwell handbook of early childhood development*. Blackwell Publishing. https://doi.org/10.1002/9780470757703.ch14.

Stubbs, S. (2008). *Inclusive education. Where there are few resources*. Oslo: The Atlas Alliance Publ.

Valiente, C., Lemery-Chalfant, K., & Castro, K. S. (2007). Children's effortful control and academic competence: Mediation through school liking. *Merrill-Palmer Quarterly, 53*(1), 1–25. https://doi.org/10.1353/mpq.2007.0006

Williford, A. P., Whittaker, J. E., Vitiello, V. E., & Downer, J. T. (2013). Children's engagement within the preschool classroom and their development of self-regulation. *Early Education and Development, 24*, 162–187. https://doi.org/10.1080/10409289.2011.628270

World Health Organization. (2007). *International classification of functioning, disability, and health - children and youth version*. World Health Organization.

World Health Organization. (2013). *How to use the ICF: A practical manual for using the international classification of functioning, disability, and health (ICF)*. World Health Organization.