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Basic Executive Functions in Early Childhood Education and their Relationship with Social Competence

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Abstract

Due to the relationship found in several studies between executive functions deficits and different psychopathological and behavioral disorders, research on the development of executive functions in children have increased in the last decade. In addition, the increase and improvement of executive functions have linked to the development of social competence. Also, the increase and improvement of social competence and academic achievement have also linked to the development of these functions. However, the researches that study the relationship between executive functions and social competence have focused mainly in adolescence and adulthood, or in people with some kind of disorder. Being less frequent studies in people without any neurological or psychological pathology or in child population. For this reason, the aim of this research is to understand the relationship between executive functions and social competence in children aged 5 years without associated pathologies. The study involved 119 students (60 boys and 59 girls) from 5 years of age, enrolled in the last year of Kindergarten, in two private but publicly funded schools in Granada. The results indicate that there is a positive relationship between social skills and executive functions. However, intervention programs in social competence rarely include executive functions as a key element to be worked on.

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1. Introduction

Antisocial behavior is a complex construct that can not be clearly conceptualized in a single framework, covering a wide range of disapproved social behavior (Rutter, 2003). However, most authors agree that antisocial behavior refers to a set of behaviors that involve property destruction, social norms violation and others basic rights humiliation and violation (Clakins & Keane, 2009; Murray & Farrington, 2010).

These behaviors are considered multi-causal nature, associated with several risk factors that enhance the development of these behaviors, such as contextual, personal, school or family factors (Farrington, 2005).

In addition to risk-factors, there are many protective-factors that promote the reduction of these risk-factors and facilitate that individuals acquire the skills so that their development is standardized, being social competence one of the most important factors in preventing antisocial behavior (Justicia, Benítez, Pichardo, Fernández, García, & Fernández, 2006). In this line, recent research has shown that good social skills are a protective factor against antisocial behavior such as bullying (Ttofi, Bowes, Farrington & Lösel, 2014; Vassallo, Edwards, Olsson & Renda, 2013)

Social competence is understood as the range of skills that allows the person to establish positive interpersonal relationships and facilitates an adequate social and scholar adjustment (Bierman & Welsh, 2000; Mcloughlin, 2009).

In addition, social competence performs a key role in preventing aggression, drug abuse, social isolation, crime or behavior problems such as peer abuse (Patterson, Capaldi, & Bank, 1991; Webster-Stratton, Reid, & Hammond, 2001).

The difficulties in establishing good social relationships enhance psychological disorders development (Corapci, 2008). Moreover, there are consolidated relationship between social competence in early childhood and subsequent academic, social and psychological adjustment. Consequently, practice and learning social skills that shape social competence favoring adaptation, being essential to develop programs in early childhood intervention (Paula, 2001).

In addition, early interventions have a much lower economic cost for public administration (Reynolds & Temple, 2012), and, without such interventions, behavioral, emotional and social problems tend to worsen (Daly, Nicholls, Aggarwal, & Sander, 2014).

Social Competence and Executive Functions

Although there is no clear and uniform definition of executive functions, many authors agree that executive functions are the set of cognitive processes of higher order, allowing us to achieve objectives through self-regulation strategies, planning and resolution problems use (Séguin & Zelazo, 2005). Also, these functions include a neurocognitive processes series that allow our behavior is goal-directed and intentional, such as setting goals, selecting appropriate behaviors and incorrect behavior inhibition, organizing tasks, design plans and effective monitoring of himself (Delgado-Mejía & Etchepareborda, 2013; Gligorovic & BuhaĐurovic, 2012; Schoemaker, Mulder, Dekovic, & Matthys, 2013; Zelazo & Carlson, 2012).

Executive functions development is a long and complex process, which begins in pregnancy and extends into adulthood, and it is influenced by a variety of exogenous and endogenous processes (Anderson & Spencer-Smith, 2013).

Currently, several authors establish three basic executive functions: inhibition, working memory and cognitive flexibility (i.e., Diamond, 2013; Miyake, Friedman, Emerson, Witzki, Howerter, & Wager, 2000).

In this way, one of the essential processes of executive functions is inhibitory control, defined as the ability to control behavior, thoughts, attention and emotions choosing the needed or more appropriate answer option in a particular context, eliminating the preponderant but inadequate response and allowing individuals adjustment to social norms (Diamond, 2013). Moreover, it relates significantly with adaptive behavior in early childhood and can be a predictor of development (Eisenberg, Hofer, & Vaughan, 2007; Gligorovic & BuhaĐurovic, 2012).

Another executive functions basic processes is working memory, it is a term that refers to the ability to temporarily hold information in mind, select, manipulate and transform it without being perceptually present, guiding behavior toward a future goal (Baddeley, 1992; Ziermans et al., 2012). Inhibitory control, attached to working memory, can enhance the cognitive flexibility development of, essential for solving social conflicts, since it involves the ability to change interpersonal perspective (look at objects and situations from the point of view of another person).

Executive functions develop and improve very quickly from 3 to 5 years old, and it is in this period when first differences arise in cognitive functions (Zelazo, Frye, & Rapus, 1996). These individual differences in emotions

cognitive regulation, actions and thoughts are related to other variables, favoring or harming a healthy adaptation (Holmes, Kim-Spoon, & Deater-Deckard, 2016).

In the same way, children's interactions with peers plays a fundamental role in executive function development, such as increased cognitive flexibility, impulsive responses inhibition (Peterson & Flanders, 2005), and self-regulation progress (Lindsey & Colwell, 2003). However, not all children experience positive interactions with peers (Iyer, Kochenderfer-Ladd, Eisenberg, & Thompson, 2010). Children who are rejected and have difficulty to develop an appropriate social setting are more likely to develop cognitive problems because these negative interactions have implications in the short and long term (Holmes et al., 2016). Along this line, Deater-Deckard (2001) showed that children of 4 years of age who had difficulty establishing interactions with peers, when they were assessed at 7 years of age, physical and cognitive skills evinced lower than their peers.

Similarly, Morgan & Lilienfeld (2000) conducted a meta-analysis and found the existence of relations between antisocial behavior and deficits in executive functions.

By contrast, the increase and improvement of social competence has been linked to executive functions development (Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009; Stelzer, Cervigni, & Martino, 2011). In this way, the problems presence with peers promote executive functions reduction in children, while healthy executive functions development increase the establishment of healthy peer relationships (Holmes et al., 2016).

However, research that study the relationship between executive functions and social competence have focused mainly in adolescence and adulthood, or in people with some kind of disorder, having few studies in early childhood education or in people without any neurological or psychological pathology. For this reason, the aim of this research is to understand the relationship between executive functions and social competence in children of 5 years of age without associated pathologies.

Taking into account the theoretical review performed and the research objectives, it is expected that students with high scores on executive functions assessed get higher scores in social competence, than their peers with lower scores on executive functions.

2. Method

2.1. Participants

119 students (60 boys and 59 girls) of 5 years of age participated in the study, belonging to two, similarly characterized, educational centers, situated in the city of Granada (Spain). The students' teachers likewise participated in the study.

2.2. Measures

In order to evaluate each student for each of the variables analyzed, the following methodologies were employed:

Social competence. The social competence of students was assessed using the Observation in Early Childhood Education scale (EOEI), a translation and adaptation to Spanish (Fernández et al., 2010) of *Preschool and Kindergarten Behavior Scale for Teachers and Caregivers* (PKBS-2) (Merrell, 2002). It is completed based teachers or caregivers previous observation of the children's behavior. It is composed of 76 items that measure the behavior problems and social competence of children from 3 to 6 years old.

However, for the current investigation only the 34 items corresponding to the scale of social competence were used subdivided into three sub-scales: social cooperation (12 items), social interaction (11 items) and social independence (11 items). The questionnaire presents a Likert scale with response values from 0 (never) to 3 (often).

Benitez, Pichardo, García Fernández, Justice, confirmed the structure of the scale in a Spanish population & Fernandez de Haro (2011), through a confirmatory factor analysis with appropriate setting values and reliability.

The reliability analyses conducted for the current investigation confirmed the distribution along the scale in the Spanish sample: social cooperation $\alpha=.94$; social interaction $\alpha=.95$; and social independence $\alpha=.93$, and for the total of social competence $\alpha=.98$.

Deficits in executive functions. Deficits in executive functioning were evaluated through BRIEF-P. Behavioral evaluation of executive function – infant version, created by Gioia, Espy, & Isquith (2002) and adapted for Spanish

by Bausela & Luque (2016). This scale is made up of a Likert scale of 63 items, with 3 possible responses, from 0= <<never>> to 2= <<frequently>>. It is completed based teachers' or parents' previous observation of the children's behavior and is composed of 6 scales:

- Inhibition: evaluating the presence of inhibitory control problems in the child, that is, in their capacity to inhibit, resist or to not react to an impulse, as well as the existence of difficulties in halting or 'braking' their own behavior at the appropriate moment.
- Flexibility: evaluating the presence of problems in the child with changing freely from one situation, activity or aspect of a problem to another, as required by circumstances.
- Emotional control: addressing the manifestation of problems with executive function within the emotional sphere and evaluating the existence of difficulties in moderating emotional responses in the child.
- Working memory: measuring the presence of difficulties in maintaining information in the mind with the objective of completing a task or giving a response.
- Planning and organization: measuring the level of problems the child has with managing current and future demands of a task, taking into account the situational context.

The reliability analyses conducted for this investigation confirmed the distribution along the scale in the Spanish sample: inhibition $\alpha=.96$; working memory $\alpha=.94$; flexibility $\alpha=.73$; planning $\alpha=.84$; emotional control $\alpha=.89$; and for the total of the scale $\alpha=.96$.

2.3. Procedure

Once the documentation and researched plan was done, contact and authorization was sought from the participating centers. Once permission was obtained from the centers and teaching staff, and, after obtaining informed consent from the participants' parents, the objectives of the investigation were explained to the third year pre-school teachers. Later, a period of observation was initiated, in which the teaching staff observed the children's behavior from December until March. After this period, the teachers proceeded to complete the social competence and executive function questionnaires.

The final stages were the data analysis and reporting. In addition an individualized report of each student where the results are captured, in order to inform parents and teachers was conducted.

3. Results

Considering that scale high scores are at 2 points, mean scores on executive functions (Table 1) show that children had low scores on all variables analyzed (lack of inhibition, lack of flexibility, memory problems, lack of planning, problems with emotional control and deficits in executive functions). Children obtained the lowest mean in lack of flexibility and the highest mean in lack of inhibitory control.

Table 1. Mean scores, Standard deviations and maximum and minimum scores obtained by children in executive functions

	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Lack of inhibition	0.60	.57	0	1.94
Lack of flexibility	0.27	.27	0	1.20
Memory problems	0.58	.44	0	1.88
Lack of planning	0.52	.36	0	1.90
Problems with emotional control	0.49	.41	0	1.70
Deficits in executive functions	0.49	.30	0.08	1.41

Moreover, children mean scores in social competence (Table 2) reflects intermediate values on all variables analysed (social cooperation, social interaction, social independence and the total of social competence). Children obtained the highest scores in social cooperation and the lowest scores in social interaction.

Table 2. Mean scores, Standard deviations and maximum and minimum scores obtained by children in social competence

	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Social cooperation	1.68	.54	0	2.92
Social interaction	1.39	.56	0	2.73
Social independence	1.66	.55	0.09	2.82
Total of social competence	1.58	.52	0.09	2.74

The results obtained from conducting a Pearson correlation between executive functions and social competence (Table 3) demonstrates the existence of a negative correlation between the two variables. Social cooperation correlated significantly and negatively with lack of inhibition ($r = -.47, p = .000$), memory problems ($r = -.66, p = .000$), lack of flexibility ($r = -.22, p = 0.015$), lack of planning ($r = -.52, p = .000$), problems with emotional control ($r = -.34, p = 0.000$) and with the total of deficits in executive functions ($r = -.62, p = .000$). Likewise, a significant negative correlation between social interaction and lack of inhibition was found ($r = -.25, p = .006$), memory problems ($r = -.57, p = .000$), lack flexibility ($r = -.46, p = .000$), lack of planning ($r = -.48, p = .000$), problems with emotional control ($r = -.19, p = .037$) and with the total of deficits in executive functions ($r = -.50, p = .000$).

Furthermore, a significant negative correlation was found between social independence and lack of memory ($r = -.53, p = .000$), lack of flexibility ($r = -.52, p = 0.000$), lack of planning ($r = -.41, p = .000$), problems with emotional control ($r = -.18, p = .047$) and with the total of deficits in executive functions ($r = -.44, p = .000$). However, no relationship was found between independence and social inhibition ($r = .13, p = .166$).

Finally, the total of social competence correlated significantly and negatively with lack of inhibition ($r = -.30, p = .001$), memory problems ($r = -.62, p = .000$), lack flexibility ($r = -.43, p = .000$), lack of planning ($r = -.50, p = .000$), problems with emotional control ($r = -.25, p = 0.006$) and with the total of deficits in executive functions ($r = -.55, p = .000$).

Table 3. Correlations between executive functions and social competence

	Lack of inhibition	Memory problems	Lack of flexibility	Lack of planning	Problems with emotional control	Total
Social cooperation	-.47**	-.66**	-.22*	-.52**	-.34**	-.62**
Social interaction	-.25**	-.57**	-.46**	-.48**	-.19*	-.50**
Social independence	-.13	-.53**	-.52**	-.41**	-.18*	-.44**
Total	-.30**	-.62**	-.43**	-.50**	-.25**	-.55**

* $p < .05$ (bilateral); ** $p < .01$ (bilateral)

4. Discussion

With the transition to formal education, children have to learn to control their behavior in a new and complex social environment. The move from home where their main agents of socialization are their parents, to an environment where they have to learn to live together with their peers and teachers, intensifying social interactions. The new social classroom environment provides children valuable experiences that enable practical and emotional learning and social skills, understanding social norms and develop friendships with peers (Van Lier & Deater-Deckard, 2016). The developments of executive functions facilitate the social and cognitive development of children (Jacobson, Williford, & Pianta, 2011; Van Lier & Deater-Deckard, 2016). Likewise, new experiences in school social environments may also influence the development of executive functions (Van Lier & Deater-Deckard, 2016).

The interactions of children with peers and executive functions are essential for children to have a healthy development (Holmes et al., 2016). Despite the existence of research linking early childhood maladjustment with adverse social experiences, knowledge of the impact of executive functions on the social skills of children is limited, especially in early childhood. For this reason, the objective of this research was to understand the relationship between executive functions and social competence in children aged 5 years without associated pathologies.

According to the results that have been obtained, children who obtained high scores on executive functions obtained high scores in social interaction, social cooperation and social independence, presenting a greater ability to follow instructions, improving behaviors oriented friendship, acceptance of others and their responses assertiveness and confidence separated from adults. These findings contribute to understanding the development of executive functions in early childhood and to know its close links with first social experiences among equals.

Previous studies in children with a typical development have shown that the development of executive functions facilitates the acquisition of social competence (eg Ciairano, Visu-Petra, & Settanni, 2007; Jacobson et al., 2011). There are also researches that indicate a significant influence of inhibitory control in social competence (Language, 2003; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005). Inhibitory control plays an important role in establishing interpersonal relations, setting standards and development of adaptive behavior, to be a good predictor of development (Eisenberg et al., 2007). In the same way Farley & Kim-Spoon (2014) demonstrated in a recent study the existence of bidirectional relationships between peer relationships and self-regulation in adolescents, in a way that good relations between colleagues and high social skills relate to improved autoregulation and vice versa.

However, despite the relationships found, the current investigation presents a series of limitations that should be taken into account in the interpretation and generalization of the results.

In the first place, in the study some variables that could influence relations between the executive functions and social competence, such as sex or socioeconomic situation of the participants were not controlled for. In addition, the external validity of the research is limited because the entire sample comes only from two schools located in Granada.

Secondly the cross-sectional study is so conclusions cannot establish whether these relationships remain over time. The nature of social relationships with peers changes considerably from childhood to adolescence due to changes in the individual's ability to reason, interpret and respond to relationships with others (Holmes et al., 2016). For this reason, it would be interesting carry out longitudinal studies that would take into account such limitations.

The findings of this study, supported by previous research, show that executive functions are closely related to children social skills and the quality of peer relationships. It is therefore necessary to develop preventive interventions since early childhood, where the executive functions and strengthening social skills are included.

It would be also interesting to study whether intervention in executive functions and social competence in early childhood reduces future negative social experiences in adolescence.

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