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An Observational Analysis of Executive Performance in School Children

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Background. Today's research on human executive functioning (EF) demonstrates a deepening understanding of this psychological concept as a mental process, as it has been assessed in testing contexts. But little effort has been made to approach the executive function from an ecological viewpoint, one which allows its study in the context of real life, and treats this function as simultaneously mental and behavioral.

Objective and Design. The purpose of the present research was to explore how 37 Colombian children, aged four, six, and eight years old, with typical psychological development, used their executive functions in a daily context, such as school classes.

Results. Observational analysis revealed that only 40% of the participants could control and regulate their behavior to achieve class goals. In the few cases where executive regulation was observed, socio-economic status and executive performance marked the behavioral patterns used by children to control and regulate their tasks in class.

Conclusion. Participants in this study showed that, independent of their EF performance level, their ability to use EF to control and regulate a daily activity, such as their behavior in class, depends on their ability to understand the advantages of acting executively. Most importantly, this skill differs among children by variables such as socioeconomic status.

***Keywords*:** executive function (EF), children, observational analysis, cognition, socioeconomic status (SES).

Introduction

Nowadays, studies of Executive Function (EF) address the topic principally from a cognitive and neuropsychological standpoint, which conceives it as a mental process of self-regulation and metacognition associated with neural substrates (Espy, 2004; Friedman & Miyake, 2016; Monette & Bigras, 2008; Reinberg & Banich, 2016;

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Yanwei, Grabell, Wakschlag, Huppert, & Perlman, 2016). Specifically, EF is characterized as an action by frontal-subcortical cerebral networks that control and monitor the cognitive system by planning, inhibiting, retaining, anticipating, and giving feedback to the process of making decisions, resolving conflicts, detecting and correcting errors, or solving problems (Benson, Sabbagh, Carlson & Zelazo, 2013; Fernández-Duque, Baird, & Posner, 2000; García-Barrera, Karr, & Kamphaus, 2013; Lee, Bull, & Ho, 2013; Miller, Giesbrecht, Müller, McInerney, & Kerns, 2012; Stuss & Alexander, 2000). In this sense, today's approach to understanding human EF focuses on devising mental and neurological models that explain its internal structure and dynamics.

This approach has resulted in a robust theoretical framework that understands EF as a higher mental function composed of multiple mental processes and cerebral mechanisms, such as inhibition, working memory, planning, self-regulation, flexibility, monitoring, and feedback (Carlson, Mandell, & Williams, 2004; Hughes, 2002; Shayer et al., 2015, Usai, Viterbori, Traverso, & De Franchis, 2014). But little consideration has been given to addressing EF from an ecological viewpoint: that is, a view that considers it a neuropsychological mechanism which facilitates and enhances the interaction between a person and his/her surroundings. More specifically, EF has not been studied as to how it operates in real life; how its associated mental processes are used and expressed behaviorally; or what possible environmental variables could be associated with its acquisition and development in the context of daily life.

Put in terms of the predominant approaches, this new point of view defines EF as the capacity to consciously self-regulate and adjust psychological functioning when presented with novel tasks, while keeping in mind possible future situations; it considers this deliberate control to be made possible by the cortico-subcortical networks of the prefrontal cortex.

Our contrasting approach arises from studying the genesis of the concept of EF, which reminds us that this type of functioning involves intentionally mastering one's own behavior to adapt to different contexts (Arievitch & van der Veer, 2004; Luria, 1970, 1985; Taylor, et al., 1984; Vygotsky, 1987), and arises from cultural-historical contributions to the western conceptualization of EF (Bodrova, Leong, & Akhutina, 2011; Holodynski, 2013; Lewis & Carpendale, 2009). This approach considers the control and regulation of behavior as a person's subordination of his/her present actions to the attainment of future goals through the use of mediation which can control the external environment, but also dominates the person's own behavior based on his/her personal motives and intentions (Akhutina, 2003; Arievitch & van der Veer, 2004; Del Río, 2002; Slobodchikov, 2004).

This new viewpoint on EF represents an ecological approach because it presupposes that relevant research on EF should be designed with the understanding that all mental functioning and behavioral inputs are functional entities of a person interacting with his/her surroundings to ensure his/her adaptation and survival. Mental functioning is responsible for conceptualizing the external world and synchronizing the interaction between the person and his/her surroundings, while behavior refers to the actions the person performs in that external reality to adjust his/her performance to personal motives and environmental conditions. That is, the person acts in his/her internal and external reality to ensure survival; that is

why the person's activity must be productive as it applies *to* something (environmental conditions) and *for* something (the person's own adaptation to a changing world and achievement of personal goals).

EF involves both mental functioning and behavioral inputs at the same time, rather than mental functioning only, as current cognitive and neuropsychological frameworks suggest. Therefore, EF can only be developed by an agent capable of designing, planning, and executing it. This approach differentiates between two types of agents, an agent of action and an agent that masters the action. The latter is the agent that understands, plans, performs, and monitors its own behavior, and has the capacity to lead others' executive performances. To the contrary, the agent of action can perform executively, but does not have the ability to initiate and plan *how* to act executively; he/she must be guided by an agent who has mastered executive performances. More competent individuals must develop and teach agents of action when and how to regulate and control their behavior to act executively.

On the other hand, an agent employs EF to supply a need to adjust to social and natural environments. This need generates a motive to perform executively (reasons to control and monitor one's own performance to fulfill a certain need), and a goal to be reached by acting executively. Then, EF is activated by an agent only when he/she sees the need to adjust his/her acting to ensure an optimal interaction with the environment, and when that agent has the understanding and motivation to execute an action and control it. If there is no understanding and motivation to perform executively, control and regulation of behavior would not happen. That is why this type of functioning is activated not only by novel tasks, but also by all those daily activities in which automatic responses are not sufficient, and thus require deliberate control and monitoring of their execution to ensure effective achievement.

Once a person feels the need to perform executively, the process of control and regulation of his/her own behavior starts. It develops in a step-by-step interaction with the external context, according to the principles of the perception-action cycle (Ardestani, Shen, Darvas, Toga, & Fuster, 2016; Fuster, 2004, 2015), in which cerebral mechanisms connect the organism with its environment through a circular neural processing.

In sum, we conclude that EF is a volitional act, performed consciously by an agent to adapt his/her acting to the internal motives and goals that guide him/her on how to act for personal gain.

The present study highlights the relevance of considering a more ecological viewpoint when approaching EF studies, such as the one just mentioned; to explore how EF is used in the context of real life to control and monitor behavior to enhance personal performance; and to look into what may be the variables that contribute to its acquisition and development.

Specifically, this study explores how children of four, six, and eight years old use their EF in a daily context, i.e. at school, and seeks to determine whether children demonstrating high and low EF performance on a group of psychological tests, show different executive behavioral patterns for controlling and monitoring themselves in school classes. The ages selected in this work correspond to those reported in the literature as critical periods of the development of EF in children (Anderson,

2010). Also, our selection included one preschool age, and two school age years, since our work aimed to explore executive functioning in children during their early school years.

Method

Participants

The executive functioning profiles obtained in our previous studies (Cadavid-Ruiz & Del Río, 2012; Cadavid-Ruiz, del Río, Egido, & Galindo, 2016) of 244 Colombian children aged four, six, and eight years old who attended public and private schools in Bogotá-Colombia, and who showed typical psychological development, were used to identify children with the highest (percentile scores between 80 and 100) and lowest scores (percentile scores between 1 and 20) on EF performance per age group. We then classified them according to their socio-economic status (SES)--rural, low, middle, and high. Thirty-seven of the children who met these requirements were chosen to participate in the present study. *Table 1* details their characteristics.

Table 1

Participating children

Age and EF performance	Rural SES		Low SES		Middle SES		High SES	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Four years								
Low EF	1	1	1	1		1	X	1
High EF	1	1	X	1	1	1	1	1
Six years								
Low EF	X	1	1	1	1	1	1	X
High EF	1	1	X	X	1	1	1	1
Eight years								
Low EF	1	1	1	1	1	X	1	1
High EF	X	1	X	X	1	1	1	1

Note. Boxes with an X mean that there were no children with these characteristics in the population where participants were recruited, and white boxes refer to children who did not come to school on the recording day set.

Materials

The behavior of the children during one hour in the classroom was videotaped, and transcribed using Transana (Frassnacht & Woods, 2005) software for further analysis. Specifically, observational analysis was conducted to examine whether the children activated their EF to control and regulate their behavior in class, and if they did, what the children's behavior could tell us about how they functioned executively.

Table 2

Coding system used in the observational analysis of executive functioning in school

Conceptual criteria and its categories
External structure of class activity (others' behavior) 1. Behaviors that interfere with the child's class activity 2. Non-distractive behaviors of others 3. Explicit social mediation directed to the child's proximal zone of development 4. Implicit social mediation that facilitates child's learning
Verbal behavior — silent and spoken periods 1. Not related to class activity 2. Related to class activity 3. Divided between class activity and distractors
Psychological mediation 1. Verbal mediation and/or objects used to help the child perceive and understand the purpose and steps of class activity 2. Verbal mediation and/or objects used to execute class activity (includes both physical actions, such as coloring or writing, and mental actions, such as reading, calculating, watching a movie, etc.)
Gaze direction 1. Looking at a distracting object or person 2. Neutral gaze (not looking at any point in particular, as when mentally calculating) 3. Social mediator who is directing class activity 4. Objects relevant to class activity (for example, the notebook when writing down exercise instructions)
Hand movements 1. Touching a distractor — object or person 2. Neutral movements 3. Social mediator who is directing class activity and/or the object that is being mentioned 4. Social mediator who is developing or directing class activity, and/or the object that the social mediator is using and is relevant for the child's own class activity 5. Object relevant to class activity
Body posture 1. Not appropriate for sustaining class activity 2. Sustaining class activity
Type of action 1. Distractive action 2. Action subordinate to the main class activity (for example, erasing when writing) 3. Action relevant to the class activity
Level of execution of the activity (Type of executive functioning) 1. Participating execution (when children follow the direction of others in class activity) 2. Appropriating execution (child understands what has to be done, but needs minimal orientation for executing some steps) 3. Internalized execution (child knows what has to be done and does it)

For this purpose, the transcribed videos were coded with a system which was designed for the present study, and reflects our own understanding of human executive functioning. The coding system, shown in *Table 2*, consisted of eight different categories, and was based on the idea that executive activity is carried out by an actor in a succession of stages, which integrate into one mental and behavioral process to ultimately profit from that activity. As can be seen, the criteria used to code EF activity assume that any individual who carries out an executive activity does it in a real day-to-day context, and that from the control and regulation of the execution of that activity, the individual will obtain an expected result.

In this vein, the criterion *external structure of class activity* sought to trace stimuli from the child's external environment that were relevant to his/her performance and final result: for example, verbal and non-verbal stimuli generated by others, which may or not guide the child's performance in class. The criteria of *verbal behavior*, *gaze direction*, *hand movements*, *body posture,* and *type of action* were designed to establish what the child's observable behavior could tell us about when the child activates his/her EF, and how he/she uses it to control his/her own behavior. The *psychological mediation* criterion has its conceptual roots in the work developed by Vygotsky (1995) and Del Río (2002), and was used to inquire into the symbolic and material tools that a child uses to understand, execute, and control his/her behavior. Finally, the criterion of *level of execution of the class activity* was developed to deduce the level of proficiency with which a child performs and completes classroom tasks.

All categories included codes for a continuum of executive/non-executive behaviors.

Procedure

A group of Colombian children who participated in previous work on EF development (Cadavid-Ruiz et al., 2016), and who satisfied the requirements of age, sex, and SES established for this study, were selected to participate. The main objective was to examine whether children aged four, six, and eight years, from different SES levels and with low and high EF performances, behave executively to control and regulate their behavior to accomplish one hour of class goals. After receiving parental approvals (by their signing informed consents) for their children to participate in this study, recordings of one hour of class time involving each recruited child began.

An observer previously known to the children stood at one of the front corners of the classroom before the start of the class, and placed a camera at a height that would obtain a direct view of the face and body of a child in his/her usual place, but at the same time would limit the probability that the child would feel observed. Children who were attending the same class were videotaped at the same time, and, depending upon their location, were captured on video simultaneously, or in periods that allowed tracking of their whole school activity.

The recordings started at the beginning of the class and ended when the teacher concluded it. Teachers were asked to give their classes as they normally did (as a presenter of tasks and motivator). The children were told that the observer, familiar to the children, was accompanying them to record what a day at the school was like, and would be filming other classrooms, as well as theirs.

The resulting videos were used to examine the types of class activities developed by the children, and to identify which of these activities could be considered meaningful for the children. In other words, we explored which class activities were clear enough for children to understand the structure and objectives to be achieved, so their control and regulation made sense to them. According to this reasoning, we sought to identify which activities were meaningful for each of the participants, because these activities might be the ones that children would subject to their supervision and regulation.

This first analysis consisted of a careful examination of the whole content of each videotape obtained, a description of the class activities developed in each one of them, and a subsequent rating of the children's behavior concerning their understanding of the class activity and goals. Activities were considered to be meaningful when children showed an understanding that it allowed them to achieve something concrete and tangible (e.g. building a puzzle to know its final form, or writing and drawing a card that they would give to their mother on Mother's Day), or when they understood the structure of the class activity (which steps of the class activities were initial, intermediate, and final; class elements and tools to be used; who to ask when in doubt, etc.)

The videos of class activities that were identified as meaningful were transcribed using Transana software. The transcripts included verbal content, spatial displacements, body movements, gaze direction, gestures, and postures produced by the participants, as well as teachers and classmates' verbal production and nonverbal behavior when they were interacting or being observed by a participant. Furthermore, all transcripts were marked in time intervals of one second so as to allow temporal tracking of the participants' behavior during the course of their class activity.

Once the transcripts were complete, a coding system was designed based on our understanding of EF. This system was evaluated in a pilot study with four of the final videos, which were analyzed for adjustment to the study requirements. Subsequently, transcripts were analyzed and coded with the final coding system by the same analyst at two different times, with a lapse of two months inbetween. The first rating was used to obtain frequency statistics, and thus determine the possibility that two codes would occur simultaneously, in order to explore possible behavioral patterns when children with low and high executive performances control and regulate class tasks. The second rating was used to calculate the reliability of the coding system.

Results

A group of children from an extensive study on EF was chosen to explore when and how children activate and use their EF to control and regulate activities in their daily contexts, such as school activities, and determine whether there are different patterns shown by children with different socio-demographic variables, such as sex, age, SES, as to their EF performance.

The reliability of these results was calculated with Cohen's *kappa*. The reliability mean was $\kappa = 0.92$. *Table 3* details the *kappa* values for each criterion of the coding system.

Table 3

Intra-observer reliability indices for the coding system

Criteria of the coding system	*κ*	*z*
External structure of class activity	0.95	108.55
Verbal behavior	0.93	95.03
Psychological mediation	0.79	75.00
Gaze direction	0.96	138.61
Hand movements	0.91	100.49
Body posture	0.85	80.27
Type of action	0.94	114.05
Level of execution of the activity	0.99	124.59

*Note: * p(z<.05)*

The first finding revealed that only 37 children of the 48 possible combinations of the above variables fit the criteria. As is shown in *Table 1*, few children with high SES showed low executive performances (percentile scores between 80 and 100), and few children with low SES showed high executive performances (percentile scores between 1 and 20). This finding suggests that the development of EF in Colombian children may depend to some extent on their living conditions, which are associated with their socio-economic status (For more information about this subject, consult Cadavid-Ruiz & Del Río, 2012; Cadavid-Ruiz et al., 2016).

Table 4

Children who control and regulate a meaningful activity during class hour

Age and EF Performance	Rural SES		Low SES		Middle SES		High SES	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Four years								
Low EF		1						1
High EF	1				1	1	1	1
Six years								
Low EF				1			1	
High EF	1					1		1
Eight years								
Low EF								1
High EF								1

Secondly, observational analysis run on the 37 final recordings showed that only 14 of the 37 children developed a meaningful activity during the class hour.

Table 4 shows that four years old was the predominant age, while eight years old had only two representatives. The most common SES was the high level, and the least represented was the low SES level. Moreover, boys with high EF performances were more numerous than other EF performance combinations.

When analyzing the socio-demographic variables all together, one can conclude that children of four years old, of middle and high SES levels, and with high EF performances comprise the group that tended to develop a meaningful activity during class hour, while eight-year-old children of all SES statuses and of both EF performance levels, comprise the group least likely to develop a meaningful activity during the class hour.

Observational analysis also showed that the criteria of the external structure of class activity tended to be divided between directive and distractive periods, with a slight predominance of the first. The distractive periods referred to movements and sounds generated by the classroom in the course of class activity, but which are not meant to distract children's attention. On the other hand, directive intervals are intended to explain and guide children's attention to the goals, procedures, and tasks that have to be done during the class hour. During these directive intervals, a teacher acted as a clear presenter and motivator of tasks to his/her students during the performance of the class activities.

Finally, observational analysis was used to explore possible behavioral patterns in response to the external structure of class activity, class performance and its control, and the level of EF the children used to control and regulate their class activity. Significant patterns were reported for high and low EF performances, and for four and six year olds. No calculations were made for eight year olds because of the small size of this subsample.

The results showed that children with low EF performances presented two different gaze patterns: they tended to look at and manipulate distractive objects ($X^2(2, N=5)=1492.38, p<.05$), or look at and manipulate relevant objects for the class activity ($X^2(6, N=5)=751.61, p<.05$), the first pattern prevailing over the second one. Along the same lines, this group of children tended to use psychological mediations as distraction; they spent part of class time on distraction, unlike the high-level EF performance group, which used it to guide and explore relevant objects for the class tasks ($X^2(3, N=5)=416.14, p<.05$).

For their part, children with high EF performances are distinguished by the fact that they direct their gaze to relevant others and/or objects for understanding and performing class tasks ($X^2(6, N=9)=580.74, p<.05$), and manipulate those objects that allow them to guide and execute their class activity ($X^2(2, N=9)=394.20, p<.05$). In other words, children with high EF performance levels tended to focus their gaze on manipulating objects that had been mentioned in the external structure of class activity, so to enhance their execution and ensure their success with them. They also tended to look at a distractor when they are in a distractive action, and look to relevant objects for a class activity when they are performing it ($X^2(6, N=9)=1112.56, p<.05$).

In general terms, children of four years old presented the same behavioral patterns as the group of high EF performance; meanwhile, children of six years old tended to behave similarly to the low EF performance group. Four-year-old children are distinguished from the rest in that they better inhibit distractors, main-

taining their gaze directed on the class activity (X^2 (6, $N=7$) = 246.55, $p < .05$); due to the teacher's intervention. Six-year-old children stand out by the fact that they spend more of their class activity time looking at and manipulating distractive objects than in performing the activity, even more time than that spent by children with low EF performance (X^2 (2, $N=5$) = 1418.54, $p < .05$).

When analyzing the children's types of action in relation to the external structure of class activity, we found that all children tended to be more distracted when the external structure is distractive. Children of four years old (X^2 (4, $N=7$) = 45.16, $p < .05$) and the group of low EF performance (X^2 (4, $N=5$) = 234.71, $p < .05$) also distract themselves when a social mediator is giving advice to a classmate, even though they could enhance their own class performance by attending to that advice.

The first finding suggests that children of four, six, and eight years old, regardless of their EF abilities, have difficulties self-regulating their behavior, and thus inhibiting any influence from external stimuli. The second result suggests that younger children and children with lower executive abilities had greater self-regulative difficulties since they cannot see that they could benefit from the advice given to others. In all cases, these findings highlight a low appropriation of self-regulation and inhibition to control and regulate their class activity in children aged four, six, and eight years old.

When exploring the type of executive functioning employed by children to control and perform class activities, we found that all children tended to dedicate more time to developing and regulating single steps of the class activity than to the whole task (*Table 5*). This may be because the class goals and the guides given to children are not adjusted to the children's levels of knowledge and cognitive resources. So, the children do not grasp how to use guidelines offered by the class to perform the activity as a whole, but they are capable of discerning which instructions may be relevant to executing and controlling single steps.

Table 5

X^2 values for the criterion of type of executive functioning

Children	χ^2
Four years old	χ^2 (2, N=7)=50.74, p<.05
Six years old	χ^2 (2, N=5)=21.98, p<.05
Low EF performance group	χ^2 (2, N=5)=63.99, p<.05
High EF performance group	χ^2 (2, N=9)=14.39, p<.05

Note. The group of eight years old was not included in these analyses since it did not have the minimum sample size needed for statistical analysis.

Discussion

Unlike current studies on EF that focus on investigating the mental abilities associated with this psychological process through test assessment, the present study sought to explore executive functioning from an approach that allowed a more

ecological approximation to this psychological reality. Our assumption was that EF consists of the integration of a mental process with its observable behavior to regulate and enhance a child's adaptation to his/her environment.

The findings of this particular approach revealed that only 40% of the children showed that they could control and regulate their behavior to achieve class goals. This means that less than half of these children activate their executive functioning so as to regulate and enhance their class performance. If, according to our approach, EF "turns on" when the performer of an action considers that its regulation and control may be profitable, then this first result suggests that class activities may offer too few explicit and direct motives to children for stimulating and orienting them on when and how to perform executively to achieve class goals and tasks. As a result, most of the class activities recorded developed by the children following their teacher's instructions and monitoring. Children who did not activate their EF may leave the executive role to another more competent person (an agent who masters the action), because this person is the one who always takes care of monitoring and regulating their performance in class, but is also the one who does not explain to them the importance of getting involved. This finding is in line with cultural-historical approach of social mediation (Bodrova et al., 2011; Del Río, 2002).

In the few cases where a truly executive regulation of class activities was observed, we hypothesized that these children may have obtained their motivation to control and regulate their behavior in class through parental advice, and not only from the teachers as immediate motivators. Parents may have explained the relevance of studying for achieving greater goals in life, and so made clear to the child the importance of controlling and regulating class performance. Therefore, this motivation is used to give meaning to class tasks, and to learning when and how to perform executively. Further studies along these lines are needed to confirm this hypothesis, although it is supported in the study of social motives and EF developed by Lewis & Carpendale (2009).

Children who did perform executively during their class activities revealed some of the behavioral patterns they used to control and regulate their behavior in class. Specifically, children of four, six, and eight years old, of both EF performance levels, tend to look at and perform actions of the same type: When they are looking at a distractive stimulus, they tend to be in a distractive action; when they are looking to a social mediator who is giving advice, they tend to be using the objects the social mediator is mentioning; and when they are looking at objects relevant to the class activity, they tend to be performing it.

Three variables explain some of the differences in the behavioral patterns observed in the children we evaluated: age, EF performance level, and SES. These same variables had been highlighted by studies of EF based on psychometric measures as well (Benson et al., 2013; Cadavid-Ruiz et al., 2016).

With regard to age, we found that at younger ages, more children tend to monitor their class activity. We hypothesize that the reason that more children aged four showed high EF than those aged six and eight years, and that six year olds showed higher EF than eight year olds, was because at younger ages, class contents tend to be concrete and practical, making it easier for children to understand the practical value of controlling and regulating a class activity. On the other hand, at older ages,

class contents are directed to the acquisition of knowledge *per se,* without highlighting how to use this knowledge to function in real life, and therefore the need for the child's behavior to be controlled and monitored. Additionally, we found that most of the class activities recorded consisted of design tasks familiar to the children, and that they already knew their dynamics. Few class activities were directed toward expanding the children's zone of proximal development.

We believe both points may contribute to explaining why the older children tended to control and regulate class activities to a lesser extent than the younger children.

With respect to EF performance differences, we found that at the high EF level, executive behavioral patterns prevailed. These children tended to use most of the class time to develop and monitor their class performance, and even though children with low EF performance levels spent more time in executive actions, they also dedicated more time to distractive actions than children with high EF levels. In particular, they can be looking to relevant objects for their class activity, but be manipulating distractive objects, or they use psychological mediation to understand and guide their class activity and to distract themselves from their main goal in class. Therefore, it can be said that children with high EF levels differ from children with low EF levels in that they understand how to use their executive abilities to control and regulate class tasks, and have better proficiency skills for using them.

In relation to SES differences, the expected results were obtained. Children of middle and high SES levels tend to control and regulate their classroom activities more often than children of rural and low SES levels, as was evidenced in other studies (Cadavid-Ruiz & Del Río, 2012; Cadavid-Ruiz et al., 2016). This may be due to the influence of other variables such as the quality of family and school education the children receive. We assume that families of middle and high SES levels make a special effort to guide their children on how to regulate their daily activities, so as to enhance their functionality in life.

These findings as a whole showed that EF performance levels obtained with traditional test assessment are useful to infer children's behavioral patterns to control and regulate class activities, but are poor tools for determining when children feel the need to perform executively in class activities, so as to obtain a benefit from controlling and regulating their class actions.

Limitations

Despite the advantages of the particular approach used in this study to highlight when and how children perform executively in a class activity, one of its major limitations is its low applicability to clinical contexts. Future research may focus on developing practical diagnostic tools for clinical use based on the findings, and exploring executive aspects not studied by traditional measures, such as when children feel the need to use their EF to control and regulate daily activities. On the other hand, the children's language competence may need to be taken into account since there are studies of the cultural-historical approach that had showed a strong relationship between EF performance and language competence (Bodrova et al., 2011).

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