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Original articles

The opinion of parents and teachers of students with learning disorders regarding executive function skills

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ABSTRACT

Purpose: to compare the opinion of parents and teachers of students with learning disorders, regarding executive function skills.

Methods: a cross-sectional cohort study, involving 39 students, boys and girls, with a multi-disciplinary diagnosis of learning disorders. Participants in the age range 8 to 11 years and 11 months were enrolled in Grades 3 to 5 of Primary Education I. The Behavior Rating Inventory of Executive Function (BRIEF) questionnaire, comprising one questionnaire for the parents and another for the teachers, was applied. The aim was to characterize the behavioral aspects of executive function in the school and home environments.

Results: data were statistically analyzed using non-parametric tests and significant differences in the answers provided by parents and teachers in the organization scale were found. By comparing the answers given by parents and teachers, significant differences were seen in the emotional control, planning/organization, material organization and monitoring scales.

Conclusion: based on the results of this study, one concludes that there are different perceptions of impaired executive function among parents and teachers of students presented with learning disorders. Parental answers pointed to more difficulties than those provided by the teachers.

Keywords: Executive Function; Learning Disorders; Learning

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INTRODUCTION

Executive Functions (EF), also known as cognitive control skills, are one of the self-regulation mechanisms, which include a number of higher-order cognitive processes involved in target-focused behavior, such as attention, problem solving, planning, working memory and inhibition[1,2]. Although definitions and approaches differ, EF may be described as a broad set of cognitive skills used to solve new problems. They are described as an important predictor of social and academic aspects of school readiness. This is partly due to rapid changes in EF skills in early childhood, before the child is of school age, in a more central manner due to the nature of EF skills[3-6].

Studies[3,4] consider that the relationship between EF skills and academic performance is due to the improved capacity of student to respond to the demands of the classroom more quickly or, in other words, that these students use their attention and memory skills to understand the rules of the classroom and academic content, enabling them to effectively benefit from the academic environment they are part of. This study[7] also mentioned that EF skills developed in primary school are predictors of academic performance going forward. Furthermore, in this same study, teachers reported a relationship between academic and behavioral issues among students and gaps in EF development.

Gioia and Isquith[8,9] mentioned EF as a set of supervisory functions that enable regulatory control of thoughts and actions. The authors describe a basic set of behaviors made up of specific sub-domains that adjust regulatory or management functions, such as the ability to initiate behavior, inhibit actions or competitive stimuli, select relevant tasks, plan and organize the means to solve complex problems, flexibly change strategy as required, and monitor and assess their own behavior. It also mentions the importance of operational memory to keep this information actively online for problem solving[10,11]. It also pointed out that emotional control can influence the execution of these EF domains.

In this conception, EFs serve as an integrated guiding system, exercising regulatory control of basic neuropsychological functions (such as language, visual-spatial functions, memory, emotional experiences and motor skills), enabling the child to reach the intended objective. The executive system makes active and intentional decisions regarding the output of the behavioral, and recruits the components necessary to achieve the goal. As such, executive functions have been defined as those under control or self-regulation, and that organize and guide all cognitive activities, emotional Reponses and behaviors exhibited[9,12].

EF skills among students may be measured using questionnaires filled out by parents and teachers, and scored using standard scales. Studies[13,14] mention that questionnaires completed by the parents help the diagnostic process, providing an overview of the child's behavior at home and in day-to-day activities. However, the authors also point out the need for a multi-disciplinary assessment using standard tools.

Thus, Gioia, Isquith and Guy[12] summarized eight main domains that can be reported by parents and teachers. These are: inhibit (the ability to resist or delay an impulse, appropriately stop a given activity at the right time, or both); shift (the ability to flexibly alter a problem solving strategy in the midst of solving a complex problem, to switch or alternate attention); emotional control (the ability to inhibit or modulate response, possibly associated with secondary events); initiate (the ability to initiate a task or activity, to create ideas or problem solving strategies); working memory (the process of holding information to complete a task, required to follow complex instructions); plan (the ability to anticipate future events, define targets and sequences, and develop suitable steps ahead of time to complete an associated task or action); organization (the ability to establish and maintain order in an activity, or to systematically perform a task, important as it increases the demand for independent operation); self-monitor (the ability to systematically check one's performance during or shortly after completing a task to make sure a target has been suitably met).

Studies of students with learning disorders[15-18] mentioned difficulty with planning skills, inhibit, working memory, time organization and management. Learning disorders cover a wide array of neurological impairments caused by deficits of the central nervous system that influence an individual's ability to efficiently hold, process or transmit information. These studies mention that the manifestations observed in these students include difficulty with auditory processing, thinking, mathematical-logical thinking, and speech and writing issues.

Furthermore, studies mention that students with learning disorders may also present unsuitable behavior due to compromised attention and memory, leading to problems in memory formation and learned behavior, including diminished persistence when undertaking a

task, and difficulty organizing/planning materials and strategies[18,19].

International studies mention a range of deficits in EF components among studentswith learning disorders related to working memory, inhibit, initiate and shift. These studies mentioned reading, writing and math deficits[9-11,20,21].

However, there are few studies looking at executive functions in students with learning disorders using questionnaires for both parents and teachers. This being the case, this effort reports an exploratory study that enables identifying which of these functions can be changed among this population. This study proposes that students with learning disorders may have executive function deficits that will be revealed in the school and family environment. The purpose of this study was tocompare the opinion of parents and teachers of students with executive function learning disorders.

METHODS

This study was submitted to, and approved by the Research Ethics Committee of the School of Philosophy and Sciences of the State University of Sao Paulo (FFC/UNESP - Marília - SP), CAAE 40514615.8.0000.5406. All those responsible for the students signed a Free and Informed Consent Form (ICF).

This is a cross-sectional cohort study. Thirty-nine students, boys and girls, with a multidisciplinary diagnosis of learning disorders and waiting for assessment at the Investigation Learning Disabilities Laboratory (LIDA/UNESP - FFC/Marília-SP) participated in this study. Participants ranged in age from 8 years to 11 years and 11 months, and were enrolled in grades 3-5 of Primary School I in the city of Marília-SP. The multi-disciplinary diagnosis was performed using the criteria described in the literature[22,23], and included Speech Language Pathologist, Neuropsychology, Neurologic and Pedagogical assessments.

The inclusion criteria were students presenting a signed Informed Consent Form and fulfilling the multi-disciplinary diagnostic criteria for learning disorders, with no co-presentations and not participating in any intervention programs. Students with no signed informed Consent From and those with a multi-disciplinary diagnosis of Developmental Dyslexia, Attention Deficit Hyperactivity Disorder, absence of any evidence of sensory deficits, neurological disorders and/or other genetic syndromes were excluded.

Procedure

The procedure was to apply the *Behavior Rating Inventory of Executive Function* (BRIEF) questionnaire[12]. Given the difficulties and complexities associated with assessing executive function performance, and the need for increased ecological validity of the assessment of executive function, BRIEF was developed to assess behavioral manifestations of executive function in students aged 5 to 18 years. BRIEF was designed to synthesize and standardize information provided by parents and teachers in a more reliable and efficient way, based on known psychometric properties.

The procedure is made up of two questionnaires - one for parents and another for teachers. The idea is to describe behavioral aspects of executive functions in the school and home environments. Each questionnaire is comprised of 86 items that measure Inhibit, Shift, Emotional Control, Working Memory, Planning/Organization and Material Organization. Parents and teachers were asked to complete the questionnaires once the diagnostic had been confirmed. A total of 78 questionnaires were analyzed, 39 completed by parents and 39 by teachers. A 3-point Likert scale was used: 0 (“Never”), 1 (“sometimes”) and 2 (“always”) to score the questionnaires.

Results were analyzed statistically using non-parametric tests, while Chi-squared was used to compare the distribution of responses provided by parents and teachers. The Wilcoxon Signed-Rank test was used to compare the questionnaires answered by parents and teachers. The p-value for statistical significance was set at <0.05. We used raw scores was used. For data analysis, the SPSS program (Statistical Package for Social Sciences), version 19.0 was used to process and analyze the data.

RESULTS

Table 1 shows the mean distribution, standard deviation and p-value for comparing the answers given by parents and teachers along each scale of the questionnaires, by applying Chi-squared.

Table 1. Comparison of the answers of parents and teachers completing the BRIEF scales

	Teachers				Parents			
	N	Mean	SD	p value	N	Mean	SD	p value
Inhibited	39	16.77	5.489	0.473	39	18.28	5.633	0.294
Flexibility	39	16.36	3.944	0.656	39	15.46	3.741	0.879
Emotional control	39	14.00	5.171	0.056	39	19.9	5.572	0.853
Initiative	39	13.56	3.463	0.886	39	15.15	3.407	0.345
Working Memory	39	20.77	4.631	0.371	39	21.36	4.522	0.162
Planning/Organization	39	19.28	5.165	0.722	39	25.18	5.628	0.839
Material organization	39	9.1	4.388	0.307	39	14.23	2.969	0.030*
Monitoring	39	18.95	6.181	0.726	39	16.72	4.123	0.719

(*) Statistically significant values (p<0.05). Chi-squared test.

We found significant differences (p=0.030) in the answers provided by parents regarding the organization scale, suggesting that parents and teachers have different opinions regarding this skill.

Table 2 shows the results of the Wilcoxon signed-rank test, used to compare the results of the questionnaires completed by parents and teachers. We found significant differences in emotional control (p=0.000), planning/organization (p=0.000), material organization (p=0.000) and monitoring (p=0.026). We found that, on average, parents assigned higher than teachers in emotional control, planning/organization and material organization, while in monitoring the teachers assigned higher scores.

Table 2. Comparison of answers given by parents and teachers to questionnaires

	Teachers			Parents			
	N	Mean	SD	N	Mean	SD	p value
Inhibited	39	16.77	5.489	39	18.28	5.633	0.148
Flexibility	39	16.36	3.944	39	15.46	3.741	0.322
Emotional control	39	14.00	5.171	39	19.90	5.572	0.000*
Initiative	39	13.56	3.463	39	15.15	3.407	0.070
Working Memory	39	20.77	4.631	39	21.36	4.522	0.303
Planning/Organization	39	19.28	5.165	39	25.18	5.628	0.000*
Material organization	39	9.10	4.388	39	14.23	2.969	0.000*
Monitoring	39	18.95	6.181	39	16.72	4.123	0.026*

(*) Statistically significant values (p<0.05). *Wilcoxon Signed-Rank*

DISCUSSION

The findings show that parents believe that studentswith learning disorders have problems in the emotional control, planning/organization and material organization scales. Studies[19,24,25] find that, prior to entering school, socioemotional and behavioral competences must already be established, as they favor academic learning.

These competences are related to self-regulation skills, and enable maintaining emotional, motivational and cognitive control in different situations. These allow student to modulate socially appropriate emotional reactions and the expression of their emotions (regulating the incidence, form, intensity and duration of emotional reactions, and inhibiting unsuitable emotions). Thus, to enable suitable emotional control, student must exercise the skill of self-regulation of cognitive and behavioral processes, which requires an underlying mechanism or, in other words, activation of the attentional system. This attentional system is considered an underlying mechanism of emotional control skills, and enables socially adequate behaviors[20,26].

However, failures in attentional processes have been mentioned in the literature as manifestations present in student with learning disorders, resulting in problems with emotional control[18,19]. Although the parents mentioned the ability to control emotions, studies show that students with learning disorders may be aware of their academic problems and suffer a feeling of failure in the school environment. Because of this, when they come across academic challenges, these students may present a range of maladjusted behaviors due to being emotionally ill-prepared. These include diminished persistence, low academic expectations, negative affect, lack of suitable academic skills or strategies, social and affective difficulties and diminished ability to manage time[19,27].

Because of their classroom difficulties, these students tend to reduce their own expectations of academic success, leading to negative self-perception[18,19]. Negative emotion and low levels of attention seem to have an interactive relationship in early development of cognitive and behavioral function[28]. According to parent reports, difficulty controlling emotions is related to exaggerated reactions, bursts of rage, easy crying and mood changes, among others Although results show that parent and teacher responses do not agree, the study[24] mentioned that teachers play an important role to support students, in particular those with no self-regulation skills, to be independent or autonomous apprentices. In support of this vision, evidence shows that the teacher-school link could significantly impact the ability of students with difficulties to self-regulate.

Parent opinions in this study are also related to issues of planning/organization and material organization. Regarding organization and planning, studies[16] mention that students with learning disorders have problems with time perception and organization, which has a significant impact on the quality of life of this population. The organization of daily activities - their planning and execution within a specific period of time -, is related to their own time management skills.

Furthermore, planning/organizations skills measure the ability of student to exercise management skills in a current situation and predict future actions. Planning is related to the ability to anticipate future events, set targets, plan and sequence future actions to achieve success (for example, do not anticipate time to perform a task, or have good ideas but cannot put them into practice). Results of the material organization scale show differences in parent responses, with higher average scores than those assigned by teachers. This scale shows how student use their organization skills in practice or, in other words, how they order or organize their belongings in the environment (room, desk, etc.)[12,16].

Regarding material organization, the study mentioned that this was independently associated with academic procrastination[29]. Special attention should be given to planning and organization skills, as they have implications for remediating problem behaviors. Individuals with problems in the initiate dimension normally want to be successful, but have problems getting started and may require extensive suggestions or limits before starting an activity. Those with planning and organization problems may fail to initiate academic tasks in a timely way, or stop working efficiently, as they lack the objects or materials required when they finally get down to work. They may also address tasks casually, or become overloaded with large amounts of data.

In the opinion of teachers, complaints in the school environment were related to the monitoring scale. The items on the scale used in this study were related to difficulties with self-correction, mistakes due to inattention, lack of perception that their behavior bothers others, and handing in incomplete assignments, among others[30]. Monitoring is a skill that enables student to keep track of their own behavior, thus adjusting cognitive demand and strategies based on the success or failure experienced. This skill allows the student to be aware of their own internal processes, such as learned actions and prior knowledge, and are thus a skill required for successful learning[18].

Furthermore, monitoring involves the ability to focus attention and inhibit the desire to respond to distracting stimuli. Cognitive progress in monitoring skills starts at age three and eight, and is related to memory (when and how an event happened), allowing students to monitor how they makedecisions based on this pre-existing memory[31]. This skill was highlighted by teachers, as while performing academic tasks students must monitor their behavior, access information in their memory and make decisions while performing an activity. This involves the ability to check, update and keep control of information regarding more than one task, and realize when it is required for the next step in a task, or to switch to another task[32].

Thus, the teachers in this study realized the problems experienced by the students in this study in the classroom environment, as there is more cognitive demand to perform academic activities. The same

was not mentioned by the parents, because at home, even though the students perform routine tasks, there was no perception of loss. However, in the classroom environment, activities such as reading and arithmetic require continuous monitoring. When reading, for instance, students must check if they understood the information, or if anything they read was lost. In math, they must make sure calculations were performed properly. Both cases require that students play attention and inhibit other stimuli to make the necessary self-corrections. Other studies also show that students with learning disorders have impaired monitoring skills[33-35].

Although there are few Brazilian studies on executive functions based on the opinion of parents and teachers of students with learning disorders, this study shows the importance of investigating this perception as the authors[36] found high correlations between reading, comprehension, writing and mathematical skills and executive functions.

The results of this study suggest that the EF problems presented by students with learning disorders were mentioned more by the parents, who pointed to impairment in at least three scales (emotional control, planning/organization and material organization), than by the teachers (monitoring)

Thus, the fact that this study found that parents and teachers have different perceptions of the extent to which executive functions are compromised. This could reveal that in students with learning disorders, executive function may be impaired to different extents based on the demand of the environment. However, these findings also have educational implications, as these difficulties were perceived less in the school environment, showing a need for new studies that address knowledge and the relationship between EF and learning in an educational context.

Thus, the hypothesis of this study - that students with learning disorders may have impaired executive functions -, has been confirmed, as shown by applying questionnaires answered by parents and teachers.

CONCLUSION

Based on the results of this study, we realized there are different perceptions of impaired executive function among parents and teachers of students with learning disorders. The results of this study suggest that the EF problems presented by students with learning disorders were mentioned more by the parents, who pointed to impairment in at least three scales (emotional control, planning/organization and material organization), than by the teachers (monitoring).

Despite the small size of the samples, the results allowed us to conclude that, in different situations, parents and teachers may differ regarding the executive behavior of the students. However, reports of behavior in different environments such as the classroom and home, provide additional information that can help with the diagnosis. Thus, studies such as these based on executive functions are required to develop clinical and educational interventions. However, supplemental assessments are required to check the impact of these changes on the academic performance of students with learning disorders.

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