WCLTA 2010

Assessing executive functions of Portuguese school-age students using the BRIEF

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Abstract

This study describes the process of the translation and adaptation into European Portuguese of the Behavior Rating Inventory of Executive Functions (Teacher’s version - BRIEF, Gioia, Isquith, Guy, & Kenworthy, 2000, and a version for students - BRIEF-Self-Report, Guy, Isquith, & Gioia, 2004), which provides a psychometric measure of executive functions and is frequently used in the assessment of children with developmental conditions, given its potential for screening executive dysfunctions. The Inventory was applied to 87 students with and without Learning Disabilities, from 10-13 years old, attending 5th and 6th grades in Northern Portugal.

Keywords: Assessment; Executive Functions; Learning Disabilities; Rating Inventory; Adolescents

Introduction

The term “executive function” represents a construct that is responsible for cognitive functions accountable for purposeful and problem-solving behavior over time (Gioia, Isquith, Guy, & Kenworthy, 2000). Significant aspects of executive functions are related to high-order level of cognition (anticipation, judgment, self-awareness, and decision making). Defining and measuring attention, memory, and executive functions has been considered complex over time. However, because of this concern it is important that researchers develop sensitive measures designed to assess changes within these domains of interest (Eslinger, 1996; Morris, 1996). It is critical to understand which changes occur in these domains and their relations to academic processes which will lead to children’s success in school. Executive functions, however, represent an example of a less defined and operationalized ability within the developmental perspective (Morris, 1996).

Underlying the definition of the design of this research study adopted is the solidness of a conceptual picture with significant potential for the description of students with Learning Disabilities, relative to a group of cognitive-affective-behavioral competences implied in academic success: the domain of executive functions. The construct of executive functions includes cognitive processes responsible for the coordination, direction and management of functions of the cognitive, emotional and behavioral domains, displaying diverse proposed definitions (e.g., Anderson, 1998; Barkley, 1997; Denckla, 1994; Fuster, 1989; Goldman-Rakic, 1987; Lyon & Krasnegor, 1996; Stuss & Benson, 1986; Welsh & Pennington, 1988, cited by Gioia, Isquith, Kenworthy, & Barton, 2002) which coincide in the degree of importance attributed to the most basic neuro-psychological processes during problem-solving to achieve a specific goal (Neisser, 1967, cited by Gioia et al., 2002).

With reference to the level of executive function, it is interesting to point out the corollary that, in the absence of basic competences (e.g., codification or evocation of information, that support the memorization processes) the...
associated metacognitive knowledge, as well as the control of this competence (i.e., the respective executive functions), may not develop (Guy et al., 2004). Thus, research data suggests that the assessment and intervention in Learning Disabilities should include objectives directed towards the development and mobilization of executive control (e.g., identifying the problems to be solved, planning and evaluating the use of strategic learning strategies), in addition to the goals of developing specific competencies in language skills (e.g., decoding of words, reading and comprehension of sentences, Guy et al., 2004).

In the academic context, the executive functions play a major role in the quality of performance by the students, and it is expected that students with Learning Disabilities will display a greater likelihood of greater probability of showing structural and/or functional limitations in this area (e.g., Graham, & Harris, 1996). Thus, the description of the level of executive function for students with Learning Disabilities relative to their capacity to Inhibit, Shift, Emotional Control, Monitor, Initiate, Working Memory, Planning/Organization, Organization of Materials, Monitor and Task Completion may contribute significantly to the development of effective strategies according to their needs.

As a result, measurement in this field is crucial and needed. Development of executive functions is critically dependent on memory and attention, therefore can provide a basis for achievement and success throughout the life span for children with and without Learning Problems.

**Method and Results**

To address executive functions assessment, the BRIEF Inventory was adapted to Portuguese. This study describes the process of translation and adaptation into Portuguese of the Behavior Rating Inventory of Executive Functions (teacher’s form – BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000, and student’s self-report form – BRIEF-SR; Guy, Isquith, & Gioia, 2004), which provides a Global Executive Composite (GEC) score. Two versions of the **Inventário de Classificação Comportamental de Funções Executivas** (ICCFE; Ribeiro & Santos, 2009) were developed. The ICCFE-P (teacher’s form) contains 86 items organized into eight scales that form a Behavior Regulation Index [BRI; 1) Inhibit; 2) Shift; 3) Emotional Control] and a Metacognition Index [MI; 4) Initiate; 5) Working Memory; 6) Plan/Organize; 7) Organization of Materials; 8) Monitor]. The ICCFE-A (student’s form) contains 80 items organized into eight scales that form a BRI [1) Inhibit; 2) Shift – includes Behavioral Shift and Cognitive Shift subscales; 3) Emotional Control; 4) Monitor] and a MI [5) Working Memory; 6) Plan/Organize; 7) Organization of Materials; 8) Task Completion].

Research questions that serve as guides in the design of this research study are the following: What type of basic competences, with reference to the scales and indexes which make up ICCFE-P and ICCFE-A (Ribeiro, & Santos, 2009), should students demonstrate in order to have conditions to succeed in academic achievements?; Are there differences, among these competences, between boys and girls, younger and older students, and among students of different grade levels?; How do we assess these competences in adolescents?; What characteristics are associated with students with Learning Disabilities with regard to these competences?; How can we distinguish students with Learning Disabilities from typical developing adolescents regarding these competences?; What is the relationship between these competences and academic performance by the students? And, how does the self-evaluation performed by the students regarding their level of executive function match the perception of teachers regarding the executive functions of the students?

Results presented are based on a descriptive statistical analysis of both versions of the ICCFE (Ribeiro, & Santos, 2009) according to the independent variables (i.e., group condition: students with Learning Disabilities and typically developing peers, gender, and grade level), results of the inferential analysis, and description of the psychometric proprieties of both versions of the ICCFE Inventory (Ribeiro, & Santos, 2009).

The statistical analysis obtained by the answers of the teachers and students presented in the Behavior Rating Inventory of Executive Functions – teacher's version (ICCFE-P; Ribeiro, & Santos, 2009) and student version
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The statistical approach developed was centered on the following analysis:

a) the multivariate analysis of variance (MANOVA), using as independent variables gender, age, grade level, student condition, and as dependent variables the results of the scales and indexes of the ICCFE-P and ICCFE-A (Ribeiro, & Santos, 2009);

b) bivariate correlational analysis, Pearson product-moment between the Final Grade obtained by students in the Curriculum and the results obtained in the scales and indexes of the ICCFE-P and the ICCFE-A (Ribeiro, & Santos, 2009), as well as, among the values presented in the scales and indexes of the ICCFE (Ribeiro, & Santos, 2009).

c) analysis of the psychometric characteristics of both versions of the inventory (i.e., ICCFE-P and ICCFE-A; Ribeiro, & Santos, 2009); correlational analysis between its different scales and indexes, analysis of internal consistency, and factorial analysis.

Fifteen adolescents with Learning Disabilities (aged 10-13) and 72 typically developing peers, attending 5th and 6th grades rated their executive functions on a daily basis using the Self-Report Form, and their teachers provided perceptions ratings.

Group comparisons indicate significant differences: a) teachers have a perception that adolescents with Learning Disabilities have less effective executive functioning, shift and working memory difficulties when compared with their typical peers; b) teachers’ perceptions illustrate associations between metacognitive difficulties and Final Grades (FG); c) adolescents with Learning Disabilities report minor difficulties on Behavioral Shift; c) typically developing adolescents, self-report, and teacher perceptions ratings of executive functioning are similar.

The correlations between scales and indexes are significant and positive with an internal consistency between $\alpha = .82$ and $\alpha = .98$ (Teacher’s form) and between $\alpha = .53$ and $\alpha = .94$ (Self-report form).

Factor analysis were also conducted and indicate that Behavior Regulation Index and Metacognition Index, which combine into Global Executive Composite, explains 81.63% (Teacher’s form) and 64.17% (Self-report) of the variance.

Furthermore, the analysis of the students’ performance on executive functioning, based on the Teacher’s and Self-report ratings, may play an essential role in defining specific goals in the curriculum (i.e., lessons that aim to provide structured study guides based on skills and strategies to enhance learning outcomes), enabling a more autonomous, reflective and self-regulated managing capacity of learning processes for students to achieve greater academic success.

In the teachers version (ICCFE-P; Ribeiro, & Santos, 2009), the descriptive analysis indicated higher averages for the students with Learning Disabilities, which were shown to be statistically significant for the scales Shift, Emotional Control, Initiate, Working Memory and Planning/Organization, as well as for the three indexes resulting from the total of the union of the scales: Behavioral Regulation Index, Metacognitive Index, and Global Executive Index. Thus, it was concluded that the responding teachers showed a global perception that the students with Learning Disabilities had lower levels of executive function than the students without Learning Disabilities. Contributing to the perception of the lower level of executive function by students with Learning Disabilities, are the difficulties observed in behavioral regulation, especially in: (1) switching easily between situations, activities or aspects of a problem as the situation requires, the ability to make transitions and present flexibility in problem-solving; (2) managing their emotional responses according to the demands of the moment and the context; as well as metacognitive difficulties, such as: (3) beginning a task or activity and displaying the ability to manage ideas independently; (4) keeping information available in short-term memory in order to finish a task, being able to persevere and remain interested in it; (5) anticipating possible situations or future consequences; defining objectives;
planning or putting into action, ahead of time, the steps/stages necessary to perform a task or activity; performing tasks systematically; understanding and being able to transmit main ideas or concepts.

As for the matrix of correlations between the scales and the indexes of this inventory, we find that the results are associated consistently, since perceptions of lesser executive function in any scale or index correspond to perceptions of lesser executive function in other scales and other indexes. The matrix of correlations for students without Learning Disabilities shows a higher number of correlations, these being consistent with the distribution of scales through the respective indexes. For students with Learning Disabilities, the matrix of correlations found differs from that for other students, with some of the pairs formed by scales or by the union of scale/index to which it belongs, by not showing significant correlations, suggesting a differentiated pattern of associations among the different executive dimensions.

With respect to the grade level, the observation of differences in the descriptive analysis, with the perception that students in the 5th grade showed lower levels of executive function than students in the 6th grade, appeared to be statistically significant for the scales Shift and Working Memory. Thus, the teachers observed that the 5th grade students tended to show greater difficulties in: (1) switching easily between situations, activities or aspects of a problem as the situation required, able to make transitions and show flexibility in problem-solving, as well as (2) keeping information available in short-term memory in order to finish a task, the ability to persevere and remain interested in it.

As regards students without Learning Disabilities, it is noted that the perception that the teachers showed of a lesser level of executive function tends to be associated with the averages of lower Final Grades and for a variable number of curriculum subjects.

For the students version (ICCFE-A; Ribeiro, & Santos, 2009), the descriptive analysis indicates higher averages for students with Learning Disabilities, with the exception of that shown for the scales of Inhibit, Emotional Control and Monitor, for the sub-scale Behavioral Shift and for the Behavior Regulation Index. Students with Learning Disabilities presented averages lower than students without Learning Disabilities. In relation to inferential analysis, significant statistical differences for the subscale Behavioral Shift were found. Thus, it may be concluded that the students with Learning Disabilities show a more favorable perception regarding their level of executive function, showing fewer difficulties in adapting in terms of behavior to changes shown in the environment or in their routines.

As for the matrix of correlations between the scales and the indexes of this inventory, results are associated consistently, since perceptions of lesser executive function in any scale or index correspond to perceptions of lesser executive function in other scales and other indexes. The matrix of correlations for students without Learning Disabilities shows a higher number of positive correlations, these being consistent with the distribution of scales through the respective indexes. For students with Learning Disabilities, the matrix of correlations found differs from that for the typically developing peers, with some of the pairs formed by scales or by the union of scale/index to which it belongs, by not showing significant correlations, suggesting a differentiated pattern of associations among the different executive dimensions for these students, with emphasis on the decrease in the number of significant correlations found in comparison with that found for these students in the inventory applied to teachers (ICCFE-P; Ribeiro, & Santos, 2009).

However, for students with Learning Disabilities and especially in the case of the Mathematics subject, the perceptions of lower executive function are found to be associated with higher Final Grades, this referring to difficulties in (1) switching easily between situations, activities or aspects of a problem according to the demands of the situation, the ability to make transitions and show problem-solving flexibility; (2) with reference to the ability to adapt in terms of behavior to changes found in the environment or in their routines, and (3) keeping their school materials organized and being able to organize their belongings, such as their school bag and the room. For students with Learning Disabilities, there were no significant associations for the scales Inhibit, Cognitive Shift, Emotional Control, Working Memory and Planning/Organization. Thus, for students with Learning Disabilities, it can be indicated that the executive function regarding: (4) controlling impulses and behaviors, such as, putting an end and
managing their own behavior when necessary and according to the context; (5) showing problem-solving flexibility, (6) managing their emotional responses according to the needs of the moment and the context; (7) maintaining information available in short-term memory with the objective of finishing a task or presenting an adequate response, and (8) anticipating possible future situations or consequences, using defined objectives or instructions to guide and manage their behavior in situations, planning or putting into place, in advance, the steps/stages needed to perform a task or action, are not necessarily associated with the results of the Final Grade.

Regarding the group of typically developing adolescents, no significant associations were noted for the scales, Inhibit, Emotional Control and Organization of Materials. Thus, for students without Learning Disabilities, it can be indicated that the executive function regarding: (1) controlling impulses and behavior, as well as setting limits on their own behavior when necessary and according to the context; (2) managing their emotional responses according to the needs of the moment and the context; (3) keeping their school materials organized and being able to organize their belongings, such as, such as their backpacks and the room, are not associated with the results of the Final Grades.

Conclusions

The ICCFE inventory offers clinical and educational advantages for assessing executive functions in Portuguese school-age children. Ultimately, the use of these tools may lead to a better understanding of concepts such as function/dysfunction in this field. Children with language and learning disorders should be assessed for executive dysfunction, as it is strongly related to language and learning problems. Future studies should address whether intervention in executive functions helps to improve language processing.

References


