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PERFORMANCE OF NORTHEASTERN CHILDREN FROM PUBLIC SCHOOLS ON PHONOLOGICAL AND SEMANTIC VERBAL FLUENCY TASKS

Victor Couto da Silveira Araújo
http://lattes.cnpq.br/6087644133361747

Gilmara de Lucena Leite
http://lattes.cnpq.br/4604166311090814

Abstract: **Introduction:** Verbal Fluency is a basic language function that designates the ability to produce fluent speech. Despite consisting of an essentially linguistic function, its measures have been widely developed and also used to evaluate executive aspects of verbal behavior. Performance on Verbal Fluency Tasks varies according to age, education and cognitive development. However, there are few studies in Brazil with sample data in this paradigm in public schools, which makes collecting data from different cultural contexts relevant. **Objective:** This study's main objective is to analyze the performance of public-school children in Phonological and Semantic Verbal Fluency tasks. **Methodology:** Three Phonological Verbal Fluency tasks and three Semantic Verbal Fluency tasks were carried out with 100 children aged seven to ten years old, duly enrolled in Elementary School I at public schools in the Municipal Education Network of Patos. The data found were analyzed using the Kolmogorov-Smirnov (K-S) test, Multivariate Analysis of Variance (MANOVA), followed by Analysis of Variance (ANOVA) and Post-Hoc tests. The t test, Pearson Correlation Coefficient and partial Eta squared (ηp^2) were also used. Results: There was no evidence of interaction effect between the variables gender and age; as well as the gender variable on the general performance of the participants, however, a general effect of age was found on this. The three Phonological Verbal Fluency (FVF) tasks, both individually and in combination, were influenced by age. In the Semantic Verbal Fluency (FVS) test, a significant age-related effect was found in the "animals" and "fruits" category and for the total number of correct answers in the FVS. **Conclusion:** The results found seem to be supported by neurodevelopmental aspects, since explicit memory systems have an earlier maturational course and earlier consolidation in relation to executive functions and the frontal lobes, whose development extends into adulthood. The data were compatible with the existing literature, however, compared to a study with the same methodological design with children from private neighborhood schools, children from public schools had greater difficulties when compared to those children. The possibility is raised that the socioeconomic variable may be influencing the performance of verbal fluency tasks.
Keywords: Executive Functions. Semantic Memory. Child Neurodevelopment.

INTRODUCTION

Verbal Fluency (VF) can be defined in a simplified way as a basic linguistic function that indicates the ability to produce fluent speech. However, VF has evolved with its history, and today it is considered a measure for evaluating executive processes of verbal behavior. (LEZAK; COL, 2012). Therefore, it is characterized by the ability of an individual to carry out a series of behaviors, which may be verbal or non-verbal, within a structure of established rules. (BECKER et al., 2014). For Neuropsychology, VF mobilizes other cognitive activities such as memory, attention, vocabulary, and thus concerns the ability and/or integrity to perform Executive Functions (EF) through measures based on Thurstone's model (THURSTONE; THURSTONE, 1962, apud LEZAK; COL, 2012); not restricted only to linguistic aspects, but expanding to other modalities such as painting, logic, music, etc.; and thus, characterizing a factor of intelligence and creativity (SANTANA and SANTOS, 2015).

The use of Verbal Fluency Tasks (VFT) began in 1938, in the English language, with Thurstone, with the aim of introducing cognitive assessment in intelligence tests, which became known as the Thurstone Word Fluency Test (TWFT) (THURSTONE,

1948), receiving criticism at the time for being a written test. Due to the limitations for evaluating populations with low education, illiterates or those with motor deficits, Arthur Benton in 1962 developed an oral version of the fluency test: Controlled Verbal Fluency Task (CVFT); which, in 1967, was introduced as an aphasia test item, undergoing some changes to the letters used. Around 1980, adaptations to other languages began in several countries.

TFV were initially performed on adults to evaluate frontal lobe lesions (BENTON, 1968; NEWCOMBE, 1969), however, for a few decades they have been gaining ground in the neuropsychological assessment of children and adolescents (HURKS; COL, 2006; RIVA; NICHELLI; DEVOTI, 2000). Therefore, they are sensitive and useful measures in the differential diagnosis of neuropsychiatric disorders during childhood – Attention Deficit/Hyperactivity Disorder (ADHD) and Autism Spectrum Disorders (ASD) (GEURTS; COL, 2004; MARZOCCHI; COL, 2008; PUENTES -ROZO; BARCELÓ-MARTÍNEZ; PINEDA, 2008). Because these tests involve a complex set of skills, functions and cognitive processes; and because they are easy to apply, they are widely used in clinical practice and neuropsychological research (SIMÕES; COL, 2007) with Semantic Verbal Fluency (SVF) and Phonological Verbal Fluency (FVF) being the most used VF tests (LEZAK; HOWIESON; LORING, 2004; MITRUSHINA; COL., 2005; STRAUSS; SHERMAN; SPREEN, 2006).

FVS tasks consist of recalling, orally, the largest number of words belonging to the same semantic category, in a given time, without restrictions. FVF tasks also consist of recalling, orally, the greatest number of words, in this case, that begin with the same pre-determined letter, in a given period of time, following certain restrictions. Both tests must meet universal scoring criteria. The relevance of these tests in the field of clinical neuropsychology has been accompanied by efforts to develop national and regional normative samples by several Brazilian research groups (CHARCHAT-FICHMAN; OLIVEIRA; SILVA, 2011; HAZIN; COL, 2016; LEITE; COL, 2016; MALLOY-DINIZ; COL, 2007; BRUCKI; ROCHA, 2004).

Studies in the area of psychopathology describe possible relationships between executive changes and developmental disorders, such as Autism, Tourette Syndrome, Attention Deficit/Hyperactivity and Conduct Disorder; This trend showed the need to better understand the normal development of EF. (BROCKI; BOHLIN, 2004). Data on developmental trajectories are relevant for the investigation of structural changes in functions in the brain and have a relevant impact in the clinical area by helping in the early identification of cognitive dysfunctions and enabling the development of interventions, cognitive rehabilitation and spontaneous functional recovery of the child (KAR; COL, 2011).

Although there is no agreement on the concept of Executive Functions (EF) in the literature, we can risk defining them as a set of skills and competencies that allow us to execute plans necessary to achieve a purpose. EF originates from a cognitive control mechanism, which directs and coordinates human behavior in an adaptive manner, thus allowing rapid and flexible changes in the face of new environmental experiences. (ZELACO; COL, 2003).

The components of EF that were most frequently found in a literature review by Miyake and collaborators (2000) in the construction of the Psychometric Model are Cognitive Flexibility (FC), Working Memory (MT) and Inhibitory Control (IC), which would be the basis other more complex EF such as Planning, Problem Solving and

Abstract Reasoning, which made this model widely accepted in neuropsychological studies (DIAMOND, 2013). Although correlated, the three components are constructed separately and appear in sequence throughout the school years, so that MT appears first followed by IC, which together allow the development of CF (GARON; BRYSON; SMITH, 2008).

Baddeley and Hitch (1994) proposed the MT model defined as a system of imitated capacity that allows the temporary storage and manipulation of information necessary in complex tasks such as learning, language comprehension, reasoning, and the production of consciousness itself. And the Supervisory Attention System (SAS), proposed by Norman and Shallice (1986), explains IC and FM. SAS is derived from response and scheme selection mechanisms and refers to the coordination and regulation of complex actions, acting as an organizing element of behavior so that goals can be achieved appropriately, that is, it acts by selecting the most efficient scheme. appropriate, inhibiting less efficient schemes, monitoring ongoing schemes, temporally scheduling schemes from a response containment system and creating algorithmic rules that facilitate specific schemes.

However, they can also be conceptualized as follows: (1) MT: brain system that provides temporary storage and manipulation of information necessary for complex cognitive tasks, or, organizes in terms of categories of semantically or phonologically related words; (2) IC: ability to inhibit prepotent responses or responses to distracting stimuli that interrupt the effective course of an action, or interrupt responses that are in progress; (3) FC: ability to seek alternative interpretations for the same situation, or modify the response according to the criteria established by the task. (TROYER; MOSCOVITCH; WINOCUR, 1997).

The initial signs of TM and IC appear around the seventh and eighth month of age; around three and four years of age, considerable gains are observed in these measures that mature at 12 years of age, after a leap in development that began at nine years of age (HONGWANISHKUL; COL, 2005; LEON-CARRION; GARCIA-ORZA; PEREZ- SANTAMARIA, 2004; UEHARA; COL, 2016). These abilities are influenced by the dorsolateral prefrontal and orbitofrontal cortices (UEHARA; COL., 2016) but also involve subcortical structures such as the basal ganglia, the thalamus and the cerebellum (ALVAREZ; EMORY, 2006).

When we talk about Long-Term Memory (MLP) we describe the subject's ability to acquire, retain and recover information and events that occurred several minutes, hours, days, months or years ago (BEAR; CONNORS; PARADISO, 2002). It is possible to state that the MLP system does not correspond to a unitary system, since memory deficits in amnesic patients do not seem to affect different forms of learning in an equivalent way (SQUIRE, 1986). Although they do not remember part of everyday events, their ability to acquire motor, cognitive and perceptual skills, as well as the pre-activation effect, is normally preserved (BUENO; OLIVEIRA, 2004). Therefore, MLP can be divided into Implicit Memory (IM) and Declarative (or Explicit) Memory (MD) (Figure 1).

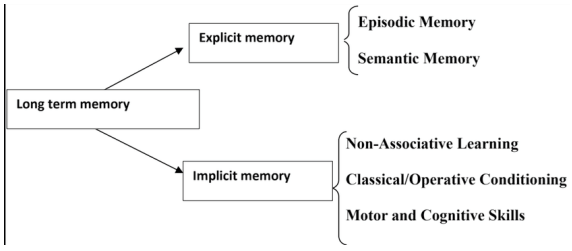

Figure 1 -Long-Term Memory Subdivisions.
Modified from Squire(1986)

Explicit Memory (MD) refers to the ability to store and consciously recall facts and events, that is, the memory can be brought to mind

verbally or non-verbally (image) (SQUIRE; ZOLA-MORGAN, 1991). The MD system can consist of both information regarding general knowledge about the world and information about specific episodes (BUENO; OLIVEIRA, 2004). This way, DM can further be divided into Semantic Memory (SM), which represents a person's knowledge about words and other verbal symbols, their meanings, as well as their rules and algorithms, thus constituting an organized knowledge of life in general and Episodic Memory (EM) (contextual recall of an experienced event, that is, where, how and when) (SQUIRE, 2004; TULVING, 1983).

In general, MS is considered a great store of knowledge about the meanings of words and the relationships between these meanings. A widely used comparison is that of the MS as a large, ultra-organized dictionary, however, the content of the MS is much more dynamic, integrated and complex than just a definition. For example, the "animals" category is organized into a general category and subcategories, for example: wild animals, domestic animals, aquatic animals or even mammals, reptiles and birds.

Therefore, TFV, both semantic and phonemic, evaluate the speed and ease of verbal production and response, mental organization and search strategies and initiation of behavior in response to a new task. These abilities correlate with the components of volition, cognitive flexibility and inhibitory control of executive functions (ANDERSON, 2002), but also comprise long-term working and semantic memories (LEZAK; HOWIESON; LORING, 2004).

Studies analyzed the effect of age on FVF in Brazilian children aged seven to ten years using three FVF categories ("F", "A" and "M") and three FVS categories (animals, clothes and fruits). Despite the international and national trend in using the letters "F", "A" and "S" in the phonological fluency task, in these studies we chose to use the letter "M" as it is more common in the Brazilian language. (CHARCHAT-FICHMAN; OLIVEIRA; SILVA, 2011; HAZIN; COL, 2016; LEITE; COL, 2016). The results found indicated an increase in children's performance with advancing age and were compatible with previous studies with Brazilian and international samples (KOREN; KOFMAN; BERGER, 2005; MALLOY-DINIZ; COL., 2007; NIETO; COL, 2008; RIVA; NICHELLI; DEVOTI, 2000; SAUZÉON; COL, 2004;).

The TFV are easy and quick to apply exams that make it possible to evaluate the development of word retrieval strategies, lexico-semantic networks (SAUZÉON; COL. 2004) and components of executive functions (CHARCHAT-FICHMAN; OLIVEIRA; SILVA, 2011). Unsatisfactory performance in the FVF and FVS tasks may indicate probable impairments in the acquisition of strategic retrieval, and, therefore, in executive functions or access to lexico-semantic networks, which may lead to academic difficulties and in learning activities of daily living (BECKER; SALLES, 2016).

Therefore, there are several subcategorizations within a semantic category. Studies indicate that the educational level and exposure to an environment that encourages the expansion of vocabulary will favor the expansion of the semantic network, that is, the formation of categories and expansion of subcategories (SAUZÉON; COL, 2004). TFV assesses not only the number of items produced in a semantic category, but also the speed in accessing such information, a capacity that is supported by good executive functioning.

The general and neuropsychological development of children can be affected by social factors, in addition to biological factors (EVANS, 2004; FARAH; COL, 2006). In this sense, socioeconomic level (SES) has been discussed as the main factor; comprising social

position, education, parental occupation, family income, family physical and mental health (ADLER; REHKOPF, 2008) and differences associated with the physical and psychosocial aspects of the environment (EVANS, 2004). Any of these factors is capable of influencing the development of the brain and neurocognitive functions (FARAH; COL, 2006) and because cognitive development is modified by gene-environment interaction mechanisms (GRAFF; MANSURY, 2008) we can highlight the limiting factor of NSE in the variation of the Intelligence Quotient (IQ) (TURHEIMER; COL, 2003).

Hackman and colleagues (2010) report that some functions appear to be more sensitive to the effects of NSE than others. Specifically, Executive Functions (ARÁN-FILIPPETTI, 2011; SARSOUR; COL, 2011), Memory (ENGEL, SANTOS; GATHERCOLE, 2008; EVANS; SCHAMBERG, 2009; EVANS and FULLER-ROWELL, 2013) and Language (FLUSS; COL, 2009; LÚCIO; PINHEIRO; NASCIMENTO, 2010; NOBLE, 2015). This can be explained by the prolonged maturation and development of these systems, which can lead to increased susceptibility to environmental differences (NOBLE, MCCANDLISS; FARAH, 2007).

Children with higher SES show superior performance in language, memory and executive functions tasks and those with low SES have greater difficulty in phonological and semantic Verbal Fluency Tasks (executive functions). Maternal education was the only SES variable that predicted verbal fluency (ARÁN-FILIPPETTI, 2011). Children of parents with higher education and from private schools showed better performance in language, memory, attention and executive functions tasks (ARDILA; COL, 2005; MATUTE-VILLASEÑOR; COL, 2009; CASTILLO; COL, 2011). Therefore, given the importance of EF in neurocognitive development, it is essential to study possible variables that may interfere in the process of brain maturation. In order to generate protective measures that support the child's neurological, psychological and cognitive development.

Hazin and collaborators (2016) developed a normative study with children aged seven to ten years from the Northeast, North and South-East regions of Brazil, from private neighborhood schools and using the same methodological design as Charchat-Fichman, Oliveira and Silva (2011). The data from this study corroborated the same previous findings, that is, age as the main factor that influences performance in TFV. One of the most relevant findings of this study was the worst performance of children from the Northeast region in almost all tasks, raising the hypothesis that not only the age variable, but also socioeconomic variables can influence the VF result.

Given the peculiar socioeconomic and cultural conditions of the Brazilian Northeast, having the largest niches of poverty and where health, education and economy still lack many investments, but, above all, due to the State of Paraíba having one of the worst Human Development Index (HDI) of the country, occupying the 23rd position, ahead only of Piauí, Pará, Maranhão and Alagoas (ATLAS DE DESENVOLVIMENTO HUMANO NO BRASIL, 2013) and due to the lack of normative data within the northeast region of Brazil with children from public schools, this work becomes important as a measure of the influence of these socioeconomic and cultural variables on cognitive development. Since this relationship has been evidenced in a series of studies, mainly with regard to Executive Functions, Memory and Language (ARÁN-FILIPPETTI, 2011; ENGEL; SANTOS; GATHERCOLE, 2008; EVANS; SCHAMBERG, 2009; EVANS and FULLER-

ROWELL, 2013; FLUSS; COL, 2009; LÚCIO; PINHEIRO; NASCIMENTO, 2010; NOBLE, 2015; SARSOUR; COL, 2011.).

In other words, because the use of TFV for cognitive assessment is something widely accepted in academic and scientific circles today, in which better performance is demonstrated with advancing age in children; The true effect of socioeconomic variables on performance in these tests is not known for sure. It is believed that this performance is proportional to the educational level and environmental factors of cognitive stimulation, generally scarce in children of low SES, which would explain a lower average score in areas with lower HDI. Therefore, evaluating the performance of children in the city of Patos-PB can be useful to measure whether there really are socioeconomic influences on these tests; which can be useful in clinical practice as an instrument for neuropsychological assessment.

For this study, we chose to use the same methodological design developed by Charchat-Fichman, Oliveira and Silva (2011); being carried out only in public schools; maintaining the criteria relating to the age group of the sample, socioeconomic level, as well as the letters and categories used to structure the tasks. This way, we can contribute to the development of normative data for verbal fluency tasks in the northeast region; as well as, developing a comparative study between public and private schools, in terms of possible quantitative differences in children's performance. Therefore, this work will contribute to the discussion about the influence of sociocultural variables on cognitive performance.

The objective of the study was to analyze the performance of public-school children aged seven to ten years old in the Northeast region on Phonological and Semantic Verbal Fluency Tasks. Furthermore, we sought to estimate the effects of the variables age and gender in relation to performance in Verbal Fluency Tasks; know the performance of the children studied considering the age factor in each variable of Phonological Verbal Fluency and in each category of Semantic Verbal Fluency; verify differences in children's performance between Phonological Verbal Fluency tasks in comparison to Semantic ones.

METHOD

The present study is an observational, cross-sectional and quantitative field research carried out with children aged seven to ten years enrolled in Elementary School I at municipal public schools in the city of Patos-PB. The selection and evaluation took place in a continuous flow over a period of one month, with a total of 100 children being investigated. The research began after submission and acceptance by the Research Ethics Committee (CEP) of ``Universidade Federal de Campina Grande`` – Campus Cajazeiras under number CAAE 59166716.2.0000.5575, being approved by opinion number 1.881.955 on December 26, 2016, signed of the Terms of Free and Informed Assent (TALE) by research participants and signing of the Term of Free and Informed Consent (TCLE) by parents or legal guardians.

The study took place in three municipal public schools in different neighborhoods in the city of Patos-PB. The neighborhoods studied were Santo Antônio, São Sebastião and Jatobá. The city of Patos is located in the countryside Paraibano mesoregion, which is one of the four mesoregions in the Brazilian state of Paraíba; it is formed by the union of 83 municipalities grouped into seven microregions. In 2014 it had a population of 893,108 inhabitants, divided into 22,720 km² of area and resulting in an average demographic density of 39 inhabitants per square kilometer.

The city of Patos is the most important urban center in this area, with a population of 105,531 inhabitants (IBGE - 2014). It is also worth noting that Patos is the metropolis that stands out most in this region, with a polarization over 70 municipalities in three states (Paraíba, Pernambuco and Rio Grande do Norte), which among other characteristics, becomes a reference for the entire mesoregion, being considered the Capital of the Sertão of Paraíba. (ATLAS OF HUMAN DEVELOPMENT IN BRAZIL, 2013).

It is important to highlight some data from the Municipal Human Development Index (IDHM) of Patos-PB. The most important thing for this work is the low Education HDI, which in 1991 was 0.265 points, in 2000 0.403 and in 2010 0.628; It can be seen that there was a growth of 0.363 points in education between 1991 and 2010, which leads to the understanding that learning is still largely out of date in this territory.

Some components evaluated in Education in 2010 that deserve to be highlighted are: (1) only 55% of the population aged 15 to 17 had completed primary education, which was only 17% in 1991; (2) 58% of children aged zero to five were out of school, which was 75% in 2000; (3) still 2.25% of children aged five to fourteen were out of school, which was 25% in 1991. These data reflect that although the new generations were in school, the older generations were not, which may be a causal factor for lower performance due to lower home incentives. (ATLAS OF HUMAN DEVELOPMENT IN BRAZIL, 2013).

POPULATION AND SAMPLING

100 children aged between seven and ten years participated in this study, 54 girls (average age = 8.5 ± 1.5) and 46 boys (average age = 8.5 ± 1.5), students from municipal public schools located in the city of Patos in the state of Paraíba, belonging to socioeconomic classes C and D (estimated from monthly family income). Literate children enrolled in regular education (Elementary Education I) whose first language was Portuguese were selected by teachers from the institutions to make up the sample. Children with a history of medical/psychiatric problems or problems related to psychotropic drug abuse were excluded. The information for establishing the criteria was collected through questionnaires to parents or legal guardians.

MATERIALS

Three Phonological Verbal Fluency tasks and three Semantic Verbal Fluency tasks were used. For FVF, the letters "F", "A" and "M" were used. In the FVS tasks, the categories "animals", "fruits" and "clothes" were used. To record the participants' responses, a response recording protocol, pencil and audio recorder were used.

PROCEDURE

The children were tested individually as follows: for FVF, they were required to recall the greatest number of words starting with the letters provided (F, A, M), within a period of 60 seconds, following some restrictions such as: derivations of the same word and proper names. For FVS, the words from each category (animals, clothes and fruits) must be freely recalled, without the establishment of restrictions, within a 60-second interval. Participants' responses were scored based on the number of correct words produced for each of the six tasks, following the correction criteria developed by Charchat-Fichman, Oliveira and Silva (2011).

STATISTICAL METHOD

Data distribution was examined using the Kolmogorov-Smirnov (K-S) test and the data met the hypothesis of normality ($p<0.05$). Based on the independent (gender and age) and dependent variables (hits in: "F", "A", "M", "animals", "clothes", "fruits", total number of correct answers in FVF, total number of correct answers in FVS and total words recalled), a multifactorial data analysis model was designed. Therefore, to verify the interference and interaction effect of the participants' gender and age variables on performance in the Verbal Fluency tests, a Multivariate Analysis of Variance (MANOVA) was initially carried out, considering Pillai's Trace as the analysis statistic. Pillai's Trace is notably the most robust among the four methods that can be used in multivariate analysis (QUINN; KEOUGH, 2002).

For statistically significant factors, MANOVA was followed by Analysis of Variance (ANOVA) and Post-Hoc tests, applying the Bonferroni correction. This approach allows controlling the type I error rate resulting from multiple comparisons, as well as obtaining estimates regarding the general multivariate influence of the independent variables on the dependent variables, and univariate differences existing within each of the gender and age groups in this study (HAIR et al., 2010). Furthermore, to investigate differences in means between the general scores of Phonological and Semantic VF, the t test for repeated measures was used and the Pearson Correlation Coefficient was used to verify possible associations between age and the results in the VPT. The effect size was measured using partial Eta squared (ηp^2) for analyzes of variance and using Cohen's d for the t-test of related measures. All analyzes were processed in PASW 18 for Windows, adopting a significance level of 5% ($p<0.05$).

RESULTS

The standardization of the sample in this study involved 100 children aged seven to ten years, of both sexes, from public schools. To verify interference and interaction effects of the independent variables on performance in the TFV, a Multivariate Analysis of Variances (MANOVA) was carried out. The results found did not show any interaction between the variables gender and age on the children's total performance ($F(0.117) = 0.602$; $p=0.897$); as well, no effect of the gender variable alone on performance in these tasks was found ($F(0.96) = 1.543$; $p=0.174$;). Therefore, the only effect found of the independent variables was the interaction of age on the participants' performance in the TFV ($F(0.413) = 2.365$; $p=0.002$).

Next, univariate effects (ANOVA) of age were observed on all FVF tasks with the following F and p values: in "F" ($F(3,94) = 8.507$; $p<0.001$); in "A" ($F(3.94) = 8.702$; $p<0.001$); in "M" ($F(3,94) = 12.79$; $p=0.003$), and in the total number of correct answers in the FVF test ($F(3,94) = 14.714$; $p<0.001$). However, when analyzing the FVS tasks, a significant effect related to age was found only in the categories "animals" ($F(3,94) = 5.559$; $p= 0.001$) and "fruits" ($F(3,94) =4.807$; $p=0.04$) and for the total number of correct answers in the FVS test ($F(3,94) = 6.056$; $p=0.001$). Therefore, no significant differences were found for the "clothes" category ($F(3.94) = 2.33$; $p=0.08$). The means and standard deviations of these tasks are presented in Table 1.

When analyzing the total number of correct answers in the Verbal Fluency Tasks, including the Phonological and Semantic VF tasks, a significant effect related to age was also found ($F(3,94) = 12.02$; $p<0.001$; $d= 0.285$).

From the Bonferroni post-hoc, significant differences were evidenced in the Phonological Verbal Fluency Tasks in the total number of

Variable	Gender	Age				ANOVA		
		7	8	9	10	Gender	Age	Interaction
F	Male	3,8 (1,6)	5,0 (3,3)	4,9 (2,5)	6,8 (2,0)	F=0,082 p=0,775 ηp^2=0,001	F=8,507 p<0,001 ηp^2=0,217	F=0,149 p=0,93 ηp^2=0,005
	Female	3,5 (1,4)	5,1 (2,7)	5,3 (2,3)	7,2 (3,1)			
	Total	3,7 (1,5)	5,1 (2,9)	5,1 (2,3)	7,0 (2,6)			
A	Male	3,8 (1,9)	4,3 (1,4)	5,2 (2,2)	6,8 (2,5)	F=1,369 p=0,245 ηp^2=0,015	F=8,702 p<0,001 ηp^2=0,221	F=0,198 p=0,898 ηp^2=0,006
	Female	3,4 (1,0)	4,3 (2,5)	4,3 (1,5)	6,1 (2,8)			
	Total	3,6 (1,5)	4,3 (2,1)	4,7 (1,9)	6,4 (2,6)			
M	Male	4,5 (2,1)	3,9 (2,9)	5,2 (2,7)	7,6 (2,9)	F=0,082 p=0,776 ηp^2=0,001	F=12,79 p<0,001 ηp^2=0,294	F=1,254 p=0,295 ηp^2=0,039
	Female	3,0 (1,5)	4,8 (2,8)	6,2 (2,1)	7,7 (2,4)			
	Total	3,8 (2,0)	4,5 (2,8)	5,8 (2,4)	7,6 (2,6)			
Total Phonetic	Male	12,1 (4,3)	13,2 (6,5)	15,3 (6,1)	21,1 (6,2)	F=0,036 p=0,851 ηp^2<0,001	F=14,714 p<0,001 ηp^2=0,324	F=0,376 p=0,77 ηp^2=0,012
	Female	9,8 (2,1)	14,3 (7,2)	15,8 (4,5)	20,9 (6,7)			
	Total	11,0 (3,6)	13,9 (6,8)	15,6 (5,1)	21,0 (6,3)			
Animals	Male	9,6 (3,8)	9,2 (3,1)	10,7 (2,5)	13,3 (3,4)	F=0,419 p=0,519 ηp^2=0,005	F=5,559 p=0,001 ηp^2=0,153	F=0,386 p=0,763 ηp^2=0,012
	Female	9,2 (2,6)	9,3 (3,3)	10,8 (2,6)	11,7 (4,0)			
	Total	9,4 (3,3)	9,3 (3,2)	10,8 (2,5)	12,5 (3,8)			
Clothes	Male	7,7 (3)	8,7 (2,5)	9,4 (2,2)	11,1 (3,3)	F=2,622 p=0,109 ηp^2=0,028	F=2,33 p=0,08 ηp^2=0,071	F=0,776 p=0,511 ηp^2=0,025
	Female	10,0 (1,5)	9,7 (4,2)	10,5 (4,1)	10,8 (2,9)			
	Total	8,8 (2,7)	9,3 (3,6)	10,0 (3,4)	11,0 (3,1)			
Fruit	Male	7,7 (2,1)	7,8 (2,0)	9,0 (2,7)	10,5 (2,4)	F=0,01 p=0,922 ηp^2<0,001	F=4,807 p=0,004 ηp^2=0,135	F=0,669 p=0,573 ηp^2=0,021
	Female	7,6 (1,7)	8,6 (2,5)	9,1 (2,4)	9,5 (2,7)			
	Total	7,7 (1,9)	8,3 (2,3)	9,0 (2,5)	10,0 (2,6)			

Total Semantic	Male	25,0 (7,4)	25,7 (6,4)	29,1 (5,5)	34,9 (7,4)	F=0,149 p=0,701 ηp^2=0,002	F=6,056 p=0,001 ηp^2=0,165	F=0,723 p=0,541 ηp^2=0,023
	Female	26,8 (3,8)	27,7 (9,2)	30,5 (8,1)	32,0 (6,9)			
	Total	25,8 (6,0)	26,9 (8,2)	29,9 (7,0)	33,4 (7,2)			
Grand Total	Male	37,1 (10,5)	38,9 (12,5)	44,4 (9,1)	56,1 (11,6)	F=0,022 p=0,881 ηp^2<0,001	F=12,202 p<0,001 eta=0,285	F=0,379 p=0,769 eta=0,012
	Female	36,6 (5,1)	41,9 (15)	46,3 (10,2)	52,9 (12)			
	Total	36,9 (8,3)	40,8 (13,9)	45,5 (9,5)	54,4 (11,7)			

Table 1 - Verbal Fluency Task Scores Between Groups and Comparative Statistical Test (ANOVA).

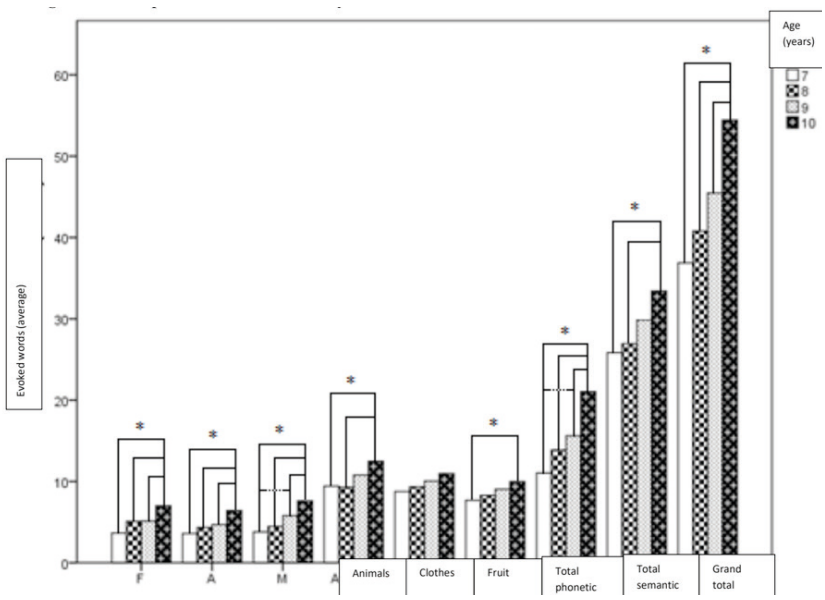

Figure 2 - Group means in verbal fluency test scores.

	F	A	M	Phonological Fluency	Animals	Clothes	Fruit	Semantic Fluency	Total
Age	0,444**	0,459**	0,551**	0,569**	0,408**	0,307**	0,385**	0,440**	0,557**
F		0,577**	0,668**	**0,878****	0,471**	0,401**	0,452**	0,531**	**0,772****
A			0,546**	**0,807****	0,532**	0,453**	0,447**	0,578**	**0,763****
M				**0,879****	0,483**	0,326**	0,353**	0,472**	**0,738****
Phonological Fluency					0,576**	0,454**	0,484**	0,611**	**0,883****
Animals						0,583**	0,556**	**0,881****	**0,822****
Clothes							0,441**	**0,832****	**0,729****
Fruit								**0,763****	**0,704****
Semantic Fluency									**0,911****

Table 2 - Correlations Between Performance and Age on Verbal Fluency Tasks

Note: * indicates p<0.05 and ** indicates p<0.01. Values in bold indicate moderate, strong and very strong correlations.

words recalled for the letter "F" between the groups of seven and ten years old (p<0.001), eight and ten years old (p= 0.031); nine and ten years (p=0.042); for the letter "A" between the groups of seven and ten years (p<0.001), eight and ten years (p=0.04) and nine and ten years (p=0.028), and; for the letter "M" between the groups of seven and nine years (p=0.043), seven and ten years (p<0.001), eight and ten years (p<0.001), nine and ten years (p=0.006).

In the Semantic Verbal Fluency tasks, significant differences were observed in the total number of words recalled for the "animals" category between participants aged seven and ten (p=0.006) and eight and ten years old (p=0.004), as well as " fruits" among participants aged seven and ten (p=0.004). The sum of correct answers in the Phonological Verbal Fluency tasks revealed significant contrasts between the performances of the groups seven and nine years old (p=0.045), seven and ten years old (p<0.001), eight and ten years old (p<0.001) and nine and ten years (p=0.006) and the total number of correct answers in the Semantic Verbal Fluency tasks was significant in the groups of seven and ten years (p= 0.001) and eight and ten years (p=0.009).

It is noteworthy that in all cases, the older age groups obtained the highest averages. Figure 2 illustrates the aforementioned results.

Pearson's correlation coefficient, also called "product-moment correlation coefficient", was used to investigate the association between variables. In this analysis, the study interest lies in the relationships between VF and age. Table 2 summarizes these results. To interpret the following values were used: 0.9 positive or negative indicates a very strong correlation, 0.7 to 0.9 positive or negative indicates a strong correlation, 0.5 to 0.7 positive or negative indicates a moderate correlation, 0.3 to 0.5 positive or negative indicates a correlation weak, 0 to 0.3 positive or negative indicates a negligible correlation.

From the table, regarding the correlations between the TFV, the strong positive correlation stands out between the total number of correct answers in FV and the variables related to performance in the six fluency tasks alone or grouped (Total number of correct answers in the TFV and its letters "F", "A" and "M", total FVS hits and its categories "animals", "clothes" and "fruits"). A strong positive correlation was also observed between the total number of FVF correct answers and the letters "F", "A" and "M" (respectively, r= 0.878, p< 0.01; r= 0.807, p< 0.01 and r = 0.879, p< 0.01). Besides, with a strong positive correlation, it was lastly observed between the total number of correct answers in the FVS and the categories "animals", "clothes" and "fruits" (respectively, r= 0.881, p< 0.01; r= 0.832, p< 0.01 and r= 0.763, p< 0.01).

Of the moderate correlations, we can highlight between "F" and "M" (r= 0.668, p< 0.01), and between total correct answers in FVF and total correct answers in FVS (r= 0.611, p < 0.01). Regarding correlations between FV and age, a moderate positive correlation was observed between age and the variables "M", total number of correct answers in FVF and total number of correct answers in FV (respectively, r= 0.551, p< 0.01; r= 0.569, p< 0.01 and r=0.557 p<0.01).

DISCUSSION

Based on the main objective of this study of analyzing the performance of public-school children aged seven to ten years in the Northeast region in Phonological and Semantic Verbal Fluency Tasks, the results found can be used to provide the scientific community with normative data from public schools and grouped according to the sociodemographic variables gender and age. This fact is important given the lack of

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data regarding the performance of healthy public-school children in TFV. Therefore, this work sought to provide evidence that could contribute to future research.

The results found in this research show that there is no interaction effect between the variables gender and age, as well as the variable gender, alone, on performance in the TFV (Phonological and/or Semantic). This evidence follows the trend of previous studies. (BRUCKI; ROCHA, 2004; CHARCHAT-FICHMAN; OLIVEIRA; SILVA, 2011; HAZIN; COL, 2016; HELENO, 2006; KOREN; KOFMAN; BERGER, 2005; LEITE; COL, 2016; MALLOY-DINIZ; COL, 2007; NIETO; COL, 2008; RIVA; NICHELLI; DEVOTI, 2000.).

However, these data show a significant effect of age on participants' performance in the TFV. Thus, the children investigated showed an increasing pattern of performance between the ages of seven and ten in all FVF tasks and in the "clothes" and "fruit" categories of the FVS tasks, with significant contrasts being found in performance across all age groups in total. of hits in the TFV. These results were different from those reported in a set of studies that found no differences in performance between eight and nine-year-old children on these tasks (CHARCHAT-FICHMAN; OLIVEIRA; SILVA, 2011; MALLOY-DINIZ; COL, 2007; NIETO; COL, 2008; RIVA; NICHELLI; DEVOTI, 2000.). However, the findings are consistent with recent studies, which point to age as one of the main variables influencing performance in VPT, as a result of neurocognitive maturational processes. (DIAMOND, 2013; HAZIN; COL, 2016; LEITE; COL, 2016; LEZAK; COL, 2012).

It is also noteworthy that there were a greater number of significant differences between the performance of the FVF tasks, observed in the post hoc analyzes of the influence of the age variable on the participants' performance. At the same time, the effect of the age variable on performance in the FVS task is not very significant in the sample studied. These data can be explained by the fact that although the assessment of the executive aspects of verbal production in the Phonological and Semantic Verbal Fluency Tasks takes place based on the coordinated activity of the frontal and temporal lobes of the left hemisphere, performance in the semantic domain depends primarily on the temporal lobe recruitment, while performance in the phonological domain depends more predominantly on frontal lobe activation (BIRN; COL, 2010; BALDO; COL, 2006; DAVIDSON; COL., 2008).

This neurocognitive organization can also explain why there are greater difficulties in the Phonological TFV compared to the Semantic TFV found in this study, considering that the children investigated obtained better results in the FVS tasks when compared to the FVF tasks. This occurs because the declarative memory systems, related to the temporal lobe, begin their development around eight months of age, with the peak of maturation between two and eight years of age. Thus, they present an earlier course of maturation and earlier consolidation in relation to executive functions and the frontal lobes, whose development begins around one year of age, and progresses gradually, until reaching the peak of maturation in adulthood around the age of 20 years. (MELLO, 2008; PAPAZIAN; ALFONSO; LUZONDO, 2006).

Therefore, the children under study were already in a state of development whose maturation context already presupposes adequate functioning of functions related to Semantic Memory and full development of Executive Functions.

Furthermore, they believe that FVF tests become more complex because they require more expressive EF performance, notably

metalinguistic skills. Differences in the very organization of the two tasks seem to underlie this discrepancy; considering that it is more structured and requires concrete elements. FVS tasks suggest in advance the conceptual categorization strategy of evoked words, circumscribing search possibilities and favoring access to the verbal lexicon. In addition to their less structured nature, FVF tasks become even more complex because they present restrictions, requiring the inhibition of inappropriate responses and monitoring of activity. Therefore, subjects capable of developing strategies to guide the evocation of words, and more competent in inhibiting impulses and monitoring the performance of tasks, will tend to obtain better performance (LEZAK; COL, 2012; RIVA, NICHELLI; DEVOTI, 2000).

Although the data from this study are compatible with the existing literature, when analyzing and comparing with a study by Hazin and collaborators (2016), with the same methodological design, but with children from private neighborhood schools, it is evident that children from Northeast has lower performance in relation to children from the North and Southeast and that children from public schools in general had a worse performance when compared to children from private schools in the same region and the North and Southeast regions, with all samples belonging to the economic classes C and D. In this analysis, it was observed that children from private neighborhood schools enjoyed better performance in almost all variables that make up the TFV, except for the ten-year-old age group where there was no significant difference between the results of the two groups.

The impact of SES (and the dimensions considered in the classifications of this variable, such as parental educational level, family income and type of school) on cognitive development and, particularly, language and EF has been observed in studies in different countries (ARDILA et al., 2005; SARSOUR et al., 2011; SBICIGO et al., 2013). And they corroborate the idea that children subjected to vulnerable and low-stimulation contexts tend to have changes in the development and functioning of the prefrontal cortex when compared to children placed in situations that favor their neuropsychological development.

Such findings point to the need for public policies that seek to minimize these socioeconomic differences and the development of pedagogical practices that take into consideration, the specificities and differences of each region, particularly the northeast region. Neuroscience is emerging as a fundamental tool to support the construction of curricular changes in public education, thus expanding dialogue between researchers, educators and civil society.

CONCLUSION

Verbal Fluency Tasks are widely used both in clinical practice and in neuropsychology research, either due to their high sensitivity in detecting changes in executive functioning and linguistic skills, or due to their psychometric characteristics, easy administration and low cost. Despite being widely used in Brazil, there is still little normative data on such tasks, specifically aimed at the public-school child population.

The results found seem to be supported by neurodevelopmental aspects, since explicit memory systems have an earlier maturational course and earlier consolidation in relation to executive functions and the frontal lobes, whose development extends into adulthood. The data were compatible with the existing literature, however, compared to a study with the same methodological design with children from private neighborhood schools, children from public schools had greater difficulties

when compared to those children. The possibility is raised that the socioeconomic variable may be influencing the performance of verbal fluency tasks.

Therefore, this study corroborates the possibility that the socioeconomic variable is influencing the performance of verbal fluency tasks. Pointing out the need for varied interpretation of verbal fluency tests and also for the implementation of public policies related to regionalized pedagogical practices and the minimization of socioeconomic differences. Based on this, we recognize the importance of future studies evaluating cognitive performance that diversify regions and expand the age range, diversify type of school and SES in addition to focusing on identifying sociocultural aspects that modify this performance.

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