

Relationship between words elicited in the Children Phonological Assessment and the variables age, gender and severity level of the phonological disorders

Relação entre as palavras eliciadas na Avaliação Fonológica da Criança e as variáveis idade, gênero e gravidade do desvio fonológico

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ABSTRACT

Purpose: To verify the relationship between words belonging and not belonging to the Children Phonological Assessment (CPA) and the variables age, gender, and severity level of phonological disorders (PD), and to analyze the most frequently produced and substituted words in the CPA. **Methods:** Participants were 45 children with PD of both genders, aged between 4 years and 7 years and 11 months. The speech corpus was composed of 6463 words, divided into belonging and not belonging in the CPA. The sample was divided according to age, gender and severity level of the PD. Data were statistically analyzed. **Results:** There was greater production of words not belonging in the CPA, and significant relationship between belonging or not belonging in the CPA according to age, gender, and severity level of PD. The target-words produced more frequently were those referring to names of objects belonging to the daily routine of children, unlike substitutions, which were more frequent when the target-word corresponded to objects visually unknown to the children. **Conclusion:** The production of the words belonging in the CPA is influenced by age, gender and severity level of phonological disorders. It is essential that the words selected for a phonological assessment consider these variables, as well as regional aspects, grammatical class of noun, and the child's repertory.

Keywords: Speech; Speech disorders; Child language; Articulation disorders; Speech articulation tests; Speech intelligibility

INTRODUCTION

Language acquisition is a process which begins in the first minutes of children's lives. The structures that are responsible for the language processing develop during children's birth and the reinforcement to the lexical development suffers interference from the linguistic environment and from the social,

economic and cultural condition of every child⁽¹⁾.

When children are about one year old almost half of the words used by them are nouns related to familiar objects, which are part of their daily routine. When children are two years old, when the vocabulary spurt occurs, the child starts to learn new words easily and quickly⁽¹⁻⁵⁾.

The lexical development and the phonological acquisition occur gradually, according to the linguistic community in which each child is inserted. The expected age of phonological system establishment is by five years old, but there is acceptable variation to this acquisition. However, some children, even older than expected, may present alterations in their speech development, difficulties to organize language mental sounds, to establish their phonological system and to adequate their received input. These cases are called phonological disorders (PD). The cause of this disorder is not completely defined, and its etiology is focus of discussion⁽⁶⁻⁹⁾.

Children who present problems of speech production, such as PD, are frequently referred to evaluation and speech-language treatment. The speech evaluation is very important and it is a critical component for the clinical process.

Study conducted at the Graduate Program in Human Communication Disorders, Universidade Federal de Santa Maria – UFSM – Santa Maria (RS), Brazil. **Grants:** Programa de Apoio a Planos de Reestruturação e Expansão das Universidades Federais (REUNI).

Conflict of interests: None

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Received: 6/14/2011; **Accepted:** 12/19/2011

It not only favors diagnosis, but it also helps the therapist to determine the best method of treatment and it provides parameters of comparison, through studies which investigate typical acquisition⁽¹⁰⁾.

Among the current phonological evaluations, the Children Phonological Assessment (CPA) is commonly used in the south of Brazil. It is a test which consists of five thematic pictures: vehicles, living room, kitchen, bathroom and zoo. These pictures stimulate the spontaneous naming of 125 different words, what allows the production of all contrastive phones, in all possible positions, regarding the word and syllable structure, with a representative sample of the language sounds⁽¹¹⁾. Some children may not elicit the expected target word and/or they may not recognize the picture/object. In these cases, the examiner may use a strategy called "delayed imitation"⁽¹⁰⁾.

It is observed, in clinical practice, that children present difficulties to elicit some words of the CPA. Some of these difficulties may be justified by lack of contact with the target words, once the aspects of the neurodevelopment are strengthened by the social relationships and by the children's environment^(12,13). In addition, the language is acquired through the use of it, mainly through the imitation of what is heard. Thus, this model emphasizes the importance of the culture during language development and acquisition.

Besides the influence of frequency, familiarity, and environmental stimulus, the word length also seems to interfere the lexical acquisition⁽¹³⁻¹⁷⁾. A study⁽¹⁰⁾ indicates that in naming and spontaneous speech tests it is common that children avoid some phonemes they cannot produce. They substitute the proposed target by another word which belongs to their lexicon.

So, children in process of lexical acquisition may perpetrate a series of semantic deviances because they still do not have an organized set of signification features that distinguish the use of a certain word, in varied linguistic contexts. Thus, the child generalizes the use of a word whose limits he/she does not control⁽⁶⁾.

The speech-language therapist action, as in cases of PD as in other pathologies, requires proper evaluation resources. According to literature^(11,18), it is essential that the collected speech corpus for phonological evaluation and analysis considers the production of all phonemes, in different syllable positions. A study⁽¹⁸⁾ mentions that the CPA and other evaluations do not consider in satisfactory way the speech-language therapist needs, because they present outdated words and/or words which do not belong to the children's vocabulary.

About what was reported, this study had the purpose of: verifying the relationship between words which belong and words which do not belong to the Children Phonological Assessment (CPA), and the variables age, gender and severity of phonological disorder (PD); analyzing the words which are produced and substituted more often in the CPA. Although the CPA does not contemplate satisfactorily the clinic needs, the evaluation is frequently used in the south of Brazil, and the importance of this study is mainly because of the method of word production analysis of the mentioned test, as well as because it provides subsidy to studies which aim at creating instruments with words for evaluation.

METHODS

This is a cross-sectional, retrospective and quantitative study. The data of this research were collected from a data basis at Universidade Federal de Santa Maria (UFSM) (RS), Brazil, created after speech samples of children with PD.

The Project was approved by the institutional Ethics Committee, n. 23081.006440/2009-60. All parents or people responsible for the children signed the free informed term of consent (FITC), authorizing the children's participation in the research.

All described procedures were performed in a standardized way, to compose the used data bases.

The inclusion criteria were: presenting normal hearing for the speech tritonal average, presenting PD, not presenting relevant neurological problems for speech production, not presenting phonetic disorder and having proper intellectual skills for language development.

After the initial speech-language screening, all subjects answered an anamnesis and they were submitted to the following evaluations: expressive and comprehensive language, phonological awareness, phonological evaluation, auditory evaluation, auditory discrimination, simplified auditory processing, stomatognathic system and articulatory examination.

The corpus speech collection for the phonological evaluation was performed through the Children Phonological Assessment (CPA)⁽¹¹⁾, in a silent room, individually. The data collection happened before the speech-language therapy. Each child was supposed to name the CPA thematic pictures. The answers were recorded and transcribed phonetically, and the results were analyzed.

From the 176 children who participated in this Project, speech samples of 45 children were selected, from male and female, with ages between four years old and seven years old and 11 months. The total of analyzed words was 6463.

The speech corpus was divided in two groups: words that belong to the CPA and words that do not belong to the CPA. Then, both groups were classified according to age group, gender and PD severity.

About age group (AG), the subjects were divided in: AG1 (11 children, from 4 years to 4 years and 11 months); AG2 (16 children, from 5 years to 5 years and 11 months); AG3 (12 children, from 6 years to 6 years and 11 months); and AG4 (six children from 7 years to 7 years and 11 months). Regarding severity, the subjects were classified according to the Percentage of Consonants Correct-Revised (PCC-R)⁽¹⁹⁾ and divided in three groups: Group 1 (G1) mild PD (15 children) (PCC-R=85 to 100%), Group 2 (G2) PD mild-moderate (17 children) (PCC-R=65 to 85%) and Group 3 (G3) moderate-severe PD (11 children) (PCC-R=50 to 65%) and severe PD (two children) (PCC-R<50%). Because of the reduced amount of children with severe PD, in this research, it was decided to include this group in the group of subjects with moderate-severe PD. About gender, the subjects were divided in: male (30 children) and female (15 children).

The data were analyzed considering if the word belongs or not to the CPA, in relation to age group, gender and PD severity. The applied statistic tests were Chi-square, complemented by

the adjusted standardized residual analysis and the Student's t-test, with significance of 5% ($p < 0.05$).

RESULTS

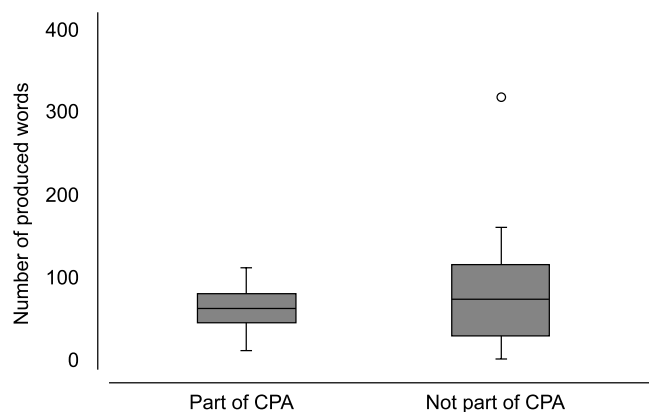
Figure 1 shows produced words which belong or not to the CPA. The average of produced words which belong to the CPA (63.71) was significantly lower than the average of produced words which do not belong to the CPA (79.91). Values which correspond to the standard deviance, minimum and maximum are also represented in the graphic.

The children produced more words which do not belong to the CPA, in two age groups. In the groups AG1 and AG2 there was higher production of words which belong to the CPA ($p < 0.0001$) (Table 1).

Regarding the difference between age groups, as male as female presented higher production of words which do not belong to the CPA ($p < 0.0001$) (Table 2).

About the PD severity, for G1 and G2 ("milder" PD levels) there was higher production of words which belong to CPA than for G3 ("more severe" PD levels) ($p < 0.0001$), as it is presented in Table 3.

Chart 1 presents the percentage of produced words which belong to the CPA. It is verified that the highest percentages of production were found for nouns, mainly animals. Besides,



t Test ($p = 0.00317$)

Note: CPA = children phonological assessment

Figure 1. Produced words, which belong or not to the CPA

the lowest percentage of production was verified for verbs.

In Chart 2, it is observed the most frequent substitutions of words which belong to the CPA. It is verified that several cases of attribution of known objects were found, similar to the presented ones. For instance, when the target was "road" and the child produced "street".

DISCUSSION

Table 1. Analysis of the number of words which belong and which do not belong to CPA, according to age group

Produced words	AG 1 n (%)	AG 2 n (%)	AG 3 n (%)	AG 4 n (%)	p-value
Part of CPA	685 (40.39) ⁽⁻⁾	1098 (48.57) ⁽⁺⁾	655 (42.48) ⁽⁻⁾	429 (42.48) ⁽⁻⁾	<0.0001*
Not part of CPA	101 (59.61) ⁽⁺⁾	1117 (50.43) ⁽⁻⁾	887 (57.52) ⁽⁺⁾	581 (57.52) ⁽⁺⁾	
Total	100.00	100.00	100.00	100.00	

*Significant values ($p < 0.05$) – Chi square test of association

Residual analysis: (+) positive association; (-) negative association

Note: AG = age group; AG1=age group 1 to 4 years old; AG2 = age group from 2 to 5 years old; AG3 = age group 3 to 6 years old; AG4 = age group 4 to 7 years old; AG1 = age group 1; CPA = children phonological assessment

Table 2. Analysis of the number of words which belong and which do not belong to CPA, according to gender

Produced words	Female n (%)	Male n (%)	p-value
Part of CPA	1043 (48.81)	1824 (42.16)	<0.0001*
Not part of CPA	1094 (51.19)	2502 (57.84)	
Total	100.00	100.00	

Significant values ($p < 0.05$) – Chi square test of association

Note: CPA = children phonological assessment

Table 3. Analysis of the number of words which belong and do not belong to CPA, according to the severity of the phonological disorder

Produced words	S1 n (%)	S2 n (%)	S3 n (%)	p-value
Part of CPA	990 (48.15) ⁽⁺⁾	1219 (45.35) ⁽⁺⁾	658 (38.28) ⁽⁻⁾	<0.0001*
Not part of CPA	1066 (51.85) ⁽⁻⁾	1469 (54.65) ⁽⁻⁾	1061 (61.72) ⁽⁺⁾	
Total	100.00	100.00	100.00	

*Significant values ($p < 0.05$) – Chi square test of association

Residual analysis: (+) positive association; (-) negative association

Note: S1 = severity 1 – mild PD; D2 = severity 2 – mild moderate PD; S3 = severity 3 – moderate severe and severe PD

Chart 1. Percentage of produced words which belong to the CPA

Percentage of production	Words
More than 80%	<i>Janela</i> (window); <i>gato</i> (cat), <i>palhaço</i> (clown), <i>guarda-chuva</i> (umbrella), <i>cobra</i> (snake), <i>flor</i> (flower), <i>peixe</i> (fish), <i>geladeira</i> (refrigerator), <i>mesa</i> (table), <i>porta</i> (door), <i>borboleta</i> (butterfly), <i>dinheiro</i> (money), <i>martelo</i> (hammer), <i>relógio</i> (watch), <i>sol</i> (sun), <i>ovo</i> (egg), <i>bolo</i> (cake), <i>toalha</i> (towel), <i>banana</i> , <i>tesoura</i> (scissors), <i>trem</i> (train), <i>cachorro</i> (dog)
Between 61 and 80%	<i>Passarinho</i> (bird), <i>tigre</i> (tiger), <i>zebra</i> , <i>lápiz</i> (pencil), <i>jornal</i> (newspaper), <i>espelho</i> (mirror), <i>pedra</i> (stone), <i>fogão</i> (stove), <i>prato</i> (plate), <i>livro</i> (book), <i>quadro</i> (picture), <i>chave</i> (key), <i>fumaça</i> (smoke), <i>bicicleta</i> (bicycle), <i>televisão</i> (television), <i>rádio</i> , <i>abacaxi</i> (pineapple), <i>dente</i> (tooth), <i>chapéu</i> (hat), <i>tapete</i> (rug), <i>chinelos</i> (sandals), <i>estrela</i> (star), <i>dragão</i> (dragon), <i>vela</i> (candle), <i>fogo</i> (fire), <i>sabonete</i> (soap), <i>nuvem</i> (cloud), <i>igreja</i> (church), <i>roda</i> (wheel)
Between 41 and 60%	<i>Calça</i> (pants), <i>garrafa</i> (bottle), <i>torneira</i> (tap), <i>sapato</i> (shoes), <i>café</i> (coffee), <i>menino</i> (boy), <i>feijão</i> (bean), <i>camisa</i> (shirt), <i>grama</i> (grass), <i>placa</i> (sign), <i>brinquedo</i> (toy), <i>disco</i> (disk), <i>prego</i> (nail), <i>criança</i> (child), <i>planta</i> (plant), <i>fruta</i> (fruit), <i>saia</i> (skirt), <i>nariz</i> (nose), <i>banquinho</i> (bank), <i>azulejo</i> (tile), <i>pia</i> (sink), <i>tio(a)</i> (uncle/aunt)
Between 21 and 40%	<i>Trilho</i> (track), <i>sino</i> (bell), <i>orelha</i> (ear), <i>navio</i> (ship), <i>globo</i> (globe), <i>cabelos</i> (hair), <i>vidro</i> (glass), <i>canos</i> (tube), <i>antena</i> (antenna), <i>botão</i> (button), <i>floresta</i> (forest), <i>blusa</i> (blouse), <i>microfone</i> (microphone), <i>verde</i> (green), <i>cruz</i> (cross), <i>braço</i> (arm), <i>pescoço</i> (neck), <i>dedo</i> (finger), <i>rabo</i> (tail), <i>estrada</i> (road), <i>armário</i> (closet), <i>chaminé</i> (chimney)
Less than 20%	<i>Estante</i> (shelf), <i>trator</i> (tractor), <i>zoológico</i> (zoo), <i>açúcar</i> (sugar), <i>franja</i> (fringe), <i>escovar</i> (brush), <i>bolsa</i> (bag), <i>âncora</i> (anchor), <i>telhado</i> (roof), <i>brincar</i> (play), <i>comer</i> (eat), <i>grande</i> (big), <i>frio</i> (cold), <i>andar</i> (walk), <i>dois</i> (two), <i>latir</i> (bark), <i>voar</i> (fly), <i>claro</i> (clear), <i>frente</i> (front), <i>pular</i> (jump), <i>olhar</i> (look), <i>soprar</i> (blow), <i>poltrona</i> (armchair), <i>esperar</i> (wait), <i>dizer</i> (say), <i>nadar</i> (swim), <i>dirigir</i> (drive), <i>tocar</i> (play)

Chart 2. The most frequent CPA words substitutions

Target-word	Substitution	Percentage (%)
Armchair	Sofa	100.00
Boy	"Guri"	94.44
Tile	Wall	94.40
Road	Street	80.00
Ship	Boat	71.43
Zebra	Horse	42.50
Dragon	Dinosaur	35.71
Radio	Sound	33.33
Globe	Planet	33.33
Disk	CD	26.32
Television	TV	24.00
Tractor	"Patrola"	19.35
Snake	Worm	16.13

The fact that the child presents more words that are not part of the CPA can be justified because the examiner does not direct the words production, but lets the subject elicit the word, according to his/her lexical-semantic domain. So, the child may have difficulties in understanding the pictures of the instrument. Although the evaluation instrument does not present all Portuguese phonemes, in all possible positions, the subject does not always elicit the words as the examiner expects.

Studies^(7,20) which investigated alterations in the expressive vocabulary of children with PD referred that the naming of pictures may be influenced by cultural and development factors. When the concept of the pictures is not acquired, attribution of known objects or objects which are visually similar may occur. According to the same studies, the child may know the object, but he/she may not know how to name it. In this case, he/she tries to produce nouns which are closer to the name of the object, in his/her own semantic repertoire.

In relation to age group, AG2 produced the highest amount words (total of 2215 words), and AG4 produced the lowest amount of words (1010 words). This distribution may be justified by the fact that older children (AG4) are more directive and do not present so many moments of spontaneous speech during the evaluation, what possibly happens with younger children (AG1 and AG2). This relationship is reinforced by a research⁽⁶⁾ which evidences that older children present better performance in vocabulary tests which regard object recognition and target word elicitation, when compared with younger children. These results confirm previous studies⁽²¹⁾ which indicate that children improve their lexical and expressive vocabulary performance as they become older.

In addition, all age groups presented higher production of words which do not belong to the CPA, what can be justified by the fact that the speech sample was not obtained through spontaneous naming and the transcription is not restrict (no more than the 125 words suggested for the evaluation).

About gender, boys produced more words than girls. However, there was higher production of words which are part of the CPA by girls. In this study, the fact that boys produced more words, can be also justified by the fact that the sample consisted, mostly, of boys. It can be also justified by the prevalence of PD, which is higher in boys, what agrees with other studies⁽²²⁾. Another research⁽²³⁾ indicates that, in vocabulary tests which use the naming strategy, girls present better performance, being more directive and obtaining higher number of expected naming.

Regarding PD severity, it is possible to perceive that G3 (children with moderate-severe and severe PD) obtained statistical significance and presented almost twice of words which do not belong to the CPA. This clue confirms what was expected by the authors of this research, because it was foreseen that, in a certain way, the PD severity levels would influence the lexical performance of the spontaneous naming, related to the targets of the used instrument.

Although the results confirm the relationship between PD severity and words elicitation of the evaluation, there are not enough studies which report the performance of children with typical phonological development. After the comparison of the performance of children with PD and the typical development, it would be possible to review the items of the test, by analyzing common difficulties of both groups without, necessarily, be interfered by the children's phonological difficulties.

The results of this research agree with the findings of another study⁽²⁴⁾ which mentions that there is a narrow relationship between the phonology and the lexicon, because it verified that children with moderate-severe and severe disorder present reduced amount of words and several of them are not targets of the evaluation. It indicates difficulties to elicit lexical elements.

There is a study⁽²⁴⁾ which reports that the naming difficulties by children with PD are caused by gaps in their lexicon, fragile semantic representations or difficulties in recovering information in the presence of well elaborated representations in their mental lexicon.

The fact that CPA produced words are, in general, nouns may be justified because this words are usually the first to be acquired by children^(25,26). Besides, it may be justified because nouns are easier to identify, because the representation through pictures of animals, such as dog or bird, are more simple and more concrete than verbs, such as bark and fly.

The identifying process, part of naming, presents three phases: object identification, known activation and generation of responses⁽¹⁹⁾. So, studies^(6,24) suggest that children with PD are able to recognize the object, but they are not able to recover the word. Thus, some words are replaced by others, with similar semantic characteristics.

The different substitutions of the CPA target-words can indicate cases of attribution of known objects, visually similar to the presented ones. For example, when the target was "armchair" the child produced "sofa". Moreover, they can reveal simplified or reduced production, such as when "television" was substituted by "TV". Besides, they can indicate that the representation of CPA words through pictures is injuring comprehension, once the provided visual input may also influence identification and naming^(18,22), such as the

pictures which represent "snake" and "dragon".

Another hypothesis for CPA target-words substitution may be related to outdated words and/or words which do not belong to the children's vocabulary, such as "disk" substituted by "CD" and "tile" replaced by "wall". Studies^(26,27) reveal that cultural and developmental factors influence the naming of pictures. Even processes of regionalism or even aspects of social and cultural environment may influence the target-words substitution, such as the word "menino" (boy) which was replaced by "guri" (the way people who live in the south of Brazil call boys) and "trator" (tractor) which was replaced by "patrola" (southern way to say tractor). Finally, the unawareness of the lexical item, or even the access to another lexical item may be connected with substitutions⁽¹⁸⁾, as, for example, the substitution of "globe" by "planet".

CONCLUSION

Considering the need of accurate instruments to diagnose PD, it is observed that, although the CPA is a phonetically balanced test, some variation in substitution of target-words occurred. It is because the children not always elicit the CPA target-words as expected by the examiner, because of difficulties to understand the pictures and/or because of influence of regionalism. So, the speech-language therapist should be attentive to balanced production of all speech sounds, important factor for a proper diagnosis.

Moreover, the production of words which are part of the CPA seemed to be influenced by age, because older children produced higher amount of words which belong to the CPA. Thus, the need of creating new proper targets for different ages is emphasized.

Besides, the gender and PD severity influenced the children's performance in CPA. Because of this, it is fundamental that the selected targets for a naming test consider such variables, as well as regional aspects. Finally, it is highlighted the importance of selecting, for these tests and/or naming tests, nouns as target words, with easy representation and words which are part of the children's repertoire.

RESUMO

Objetivo: Verificar a relação entre as palavras pertencentes e não pertencentes à Avaliação Fonológica da Criança (AFC) e as variáveis idade, gênero e gravidade do desvio fonológico (DF), e analisar as palavras produzidas e as palavras substituídas com maior frequência na AFC. **Métodos:** Fizeram parte do estudo 45 crianças com DF, de ambos os gêneros, com idades entre 4 anos e 7 anos e 11 meses. O *corpus* de fala foi composto por 6463 palavras, que foram divididas em palavras pertencentes ou não à AFC. A amostra foi dividida quanto à faixa etária, à gravidade do desvio fonológico e ao gênero. Os dados foram analisados estatisticamente. **Resultados:** Houve maior produção de palavras não pertencentes à AFC e relação significativa entre a palavra pertencer ou não ao AFC quanto à faixa etária, gênero e gravidade do DF. As palavras-alvo enunciadas com maior frequência foram equivalentes a nomes de objetos do dia a dia da criança, ao contrário das substituições, que foram mais frequentes quando a palavra-alvo correspondia a objetos não conhecidos visualmente pelas crianças. **Conclusão:** A produção de palavras pertencentes à AFC é influenciada pela idade, gênero e gravidade do DF. É fundamental que nas palavras selecionadas para uma avaliação fonológica sejam consideradas tais variáveis, bem como, aspectos regionais, classe gramatical de substantivo, e o repertório da criança.

Descritores: Fala; Distúrbios da fala; Linguagem infantil; Transtornos da articulação; Testes de articulação da fala; Inteligibilidade da fala

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