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Original Article

Artigo Original

Early lexical and phonological acquisition and its relationships

Aquisição fonológica e lexical inicial e suas inter-relações

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Keywords

Speech
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ABSTRACT

Purpose: Verifying likely relationships between lexical and phonological development of children aged between 1 year to 1 year, 11 months and 29 days, who were enrolled in public kindergarten schools of Santa Maria (RS). **Methods:** The sample consisted of 18 children of both genders, with typical language development and aged between 1 year to 1 year, 11 months and 29 days, separated in three age subgroups. Visual recordings of spontaneous speech of each child were collected and then lexical analysis regarding the types of the said lexical items and phonological assessment were performed. The number of sounds acquired and partially acquired were counted together, and the 19 sounds and two allophones of Brazilian Portuguese were considered. To the statistical analysis, the tests of Kruskal-Wallis and Wilcoxon were used, with significance level of $p<0.05$. **Results:** When compared the means relating to the acquired sounds and mean of the acquired and partially acquired sounds percentages, there was difference between the first and the second age subgroup, and between the first and the third subgroup. In the comparison of the said lexical items means among the age subgroups, there was difference between the first and the second subgroup, and between the first and the third subgroup again. In the comparison between the said lexical items and acquired and partially acquired sounds in each age subgroup, there was difference only in the age subgroup of 1 year and 8 months to 1 year, 11 months and 29 days, in which the sounds highlighted. **Conclusion:** The phonological and lexical domains develop as a growing process and influence each other. The Phonology has a little advantage.

Descritores

Fonoaudiologia
Lactente
Desenvolvimento da Linguagem
Fala
Vocabulário

RESUMO

Objetivo: Verificar possíveis inter-relações entre o desenvolvimento fonológico e lexical de crianças com idades entre 1 ano e 1 ano, 11 meses e 29 dias, matriculadas em escolas de educação infantil da rede pública municipal de Santa Maria (RS). **Métodos:** A amostra foi composta por 18 crianças de ambos os sexos, com desenvolvimento típico de linguagem e idades entre 1 ano e 1 ano, 11 meses e 29 dias, divididas em três subgrupos etários. Foram realizadas filmagens da fala espontânea de cada sujeito e, após, realizou-se análise lexical quanto aos tipos dos itens lexicais produzidos e avaliação fonológica. Foram contabilizados o número de sons adquiridos e parcialmente adquiridos conjuntamente e considerados os 19 fonemas e os dois alofones do Português Brasileiro. Para análise estatística, foram utilizados os testes de Kruskal-Wallis e Wilcoxon, com nível de significância $p<0,05$. **Resultados:** Quando comparadas as médias referentes aos fonemas adquiridos e média dos percentuais dos fonemas adquiridos e parcialmente adquiridos, houve diferença entre a primeira subfaixa e a segunda, e entre a primeira e a terceira subfaixa. Na comparação das médias dos itens lexicais produzidos entre as subfaixas etárias, pode-se observar novamente diferença entre a primeira subfaixa e a segunda, e entre a primeira e a terceira subfaixa. Na comparação entre o percentual de itens lexicais produzidos e fonemas adquiridos e parcialmente adquiridos em cada faixa etária, houve diferença apenas na subfaixa etária de 1 ano e 8 meses a 1 ano, 11 meses e 29 dias, em que os fonemas se sobressaíram. **Conclusão:** Os domínios fonológico e lexical desenvolvem-se como um crescente e influenciam-se mutuamente, com pequena vantagem da fonologia.

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Study carried out at the Centro de Estudos de Linguagem e Fala, Universidade Federal de Santa Maria – UFSM – Santa Maria (RS), Brasil.
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INTRODUCTION

The lexicon is a system constantly growing as knowledge is acquired. It is an open system, for it is constantly improving and expanding. The contact with people, in society, at work, and in many other environments, which provides human communication, also entails increasing lexical acquisition, built from an individual and heterogeneous process[1].

The lexical acquisition demands the establishment of a correspondence between phonological form of a word and its semantic representation. This correspondence is strengthened by the experience with the new word, which is characterized by the addition of perceptual, contextual, syntactic, and pragmatic information. Two factors contribute to the lexical development: the linguistic input from the parents and the cognitive abilities of the child[2,3].

Findings suggest the vocabulary and the phonological memory are related to each other since the beginning of language development[4], the phonological memory being a critical component in the learning of new words, for being involved in the formation of new long-term phonological forms[5].

Studies prove the existence of the correlation between different components of the linguistic knowledge in children with typical language development, speakers of Brazilian Portuguese. Thus, the wider the vocabulary of the child, the greater their sub-lexical and morphological language knowledge, which will facilitate the performance in activities of word and pseudoword repetition[6].

Considering that, conducting studies that correlate different language subsystems is necessary, because there is evidence in literature[4,5] that they are interconnected. In the case of children with typical language development, this investigation becomes interesting as it evidences how these relations occur, providing interesting clues to therapeutic intervention for children with language disorders.

Therefore, the objective of this study was to investigate possible interrelations between phonological and lexical development in children aged between 1 year and 1 year, 11 months and 29 days, enrolled in public preschools of Santa Maria (RS).

METHODS

This study is part of a research project being carried out at a federal educational institution, approved by its ethics committee on research under the number 0219.0.243.000-11.

This work consists of a cross-sectional, quantitative research of 18 children of 1 year of age, attending to nurseries belonging to Municipal Schools of Early Childhood Education. All children presented apparent typical language development and from to C, D, and E social strata.

The children were assessed in their schools by a PhD Speech Language and Audiology student, considering orofacial and auditory aspects and, especially, language ones, with emphasis on the phonological and lexical aspects of the language. All children were authorized to participate in the research by their legal guardians, who signed the informed consent form.

Initially, the Speech Language pathologist sent the parents a questionnaire with questions regarding pregnancy, childbirth labor, the child's overall development, especially the linguistic one, clinical history, current behavior, history of bilingualism, as well as general aspects on family dynamics.

The orofacial assessment included a brief inspection based on the protocol of orofacial myofunctional evaluation with scores[7]. Through this protocol, the orofacial structures were analyzed regarding their appearance, normal position, muscle tension and mobility, as well as the breathing function.

Oral language and cognitive aspects were assessed through the behavioral observation protocol[8]. Thus, it was possible to observe the cognitive and language development, as to their semantic, syntactic, and pragmatic aspects, as well as their motor and social behaviors. Similarly, the phonetic and phonological aspects of speech were also analyzed.

The hearing screening was carried out through visual reinforcement audiometry[9], using a portable pediatric audiometer, with pure modulated tones (warble) in the frequencies of 500, 1,000, 2,000, and 4,000 Hz and intensities from 20 to 80 dBHL. Responses between 20 and 40 dBHL were considered normal[10].

All assessments showed results within the expected patterns for the age of the studied children.

The phonetic and phonological aspects of speech, as well as the lexical items produced, were assessed by video recording the interaction between the Speech Pathologist, or the intern of the school (only in cases in which the child would refuse to play with the Pathologist), and each child for 20 minutes. During the recorded interaction, a box with several toys would be available for the child in all sessions. The toys and objects in the box were selected from a previously prepared list, based on the "phonological assessment of child speech"[11]. This instrument allows the evaluation of possibility of occurrences of each Brazilian Portuguese consonant for all possible positions in both the syllable and the word, through naming of pictures.

The video recordings were done using a Samsung camcorder (SMX-C200 model). For the phonetic transcription, the method of consensus was used[12,13], that is, two evaluator worked independently in the transcription. Then, the transcriptions were compared and the discrepancies were heard once more by a third evaluator until they reached a consensus on all the statements/words/sounds produced by the child. Thus, the reliability of the transcriptions is granted and it is avoided that a great number of words get deleted.

The phonology was analyzed by the contrastive analysis, which presents the phonological system used by the child, registering the contrasts, the substitutions, and the omissions produced by them[11]. To establish the phonological inventory, the following criteria were used[14]: occurrence of 0–39% indicates the phoneme is not yet acquired; if the occurrence is between 40 and 79%, the phoneme is partially acquired; and when the occurrence is more than 80%, the phoneme is acquired. Thus, the number of acquired and partially acquired sounds was recorded together, for some children would produce only one sound, which would limit the statistical analysis. Nineteen phonemes and two allophones of Brazilian Portuguese were taken into account.

For the study of the lexicon, the data transcription was carried out in full, containing both the child's and the interlocutor's speech, to avoid words produced by repetition to be accounted for as a new *type*. Thus, the spoken lines of the individuals were separated by words, accounting only the *types*, since the *tokens* were not relevant for this study. For the classification of the *types*, all the different words produced by the child were considered[15].

For the analysis, it was necessary to consider the lexicon as an open system, that is, we acquire words until the end of our lives, and phonology is a closed system, for we acquire only a limited number of sounds, which is given until around 5 years of age, in typical acquisition. Therefore, it would be numerically impossible to correlate both variables through a simple counting of the items. Thus, the following method was developed: we consider the maximum number of produced sounds and the maximum number of produced words ("child who spoke more") as 100%, applying the mathematical rule of three to determine the percentage of sounds and words produced by the remaining individuals.

The statistical analysis was carried out using the Kruskal–Wallis test to compare the variables "words" and "sounds" within the age ranges. As for the percentage comparison between phonemes and produced words in each age range, the Wilcoxon test for related samples was used. The significance level adopted for the statistical tests was 5% (i.e., $p<0.05$).

RESULTS

Table 1 presents the averages referring to the acquired phonemes and the average percentage of acquired and partially acquired phonemes. It is observed that children belonging to the subrange 1 year and 8 months of age to 1 year, 11 months and 29 days of age were the one with the highest percentage. There was a significant difference between the first and the second age subrange, and between the first and the third subrange.

Table 2 shows the comparison of the averages of lexical items produced between age groups. Once again, there was a difference between the first and the second subrange, and between the first and the third ones.

Figure 1 shows the comparison between the percentage of lexical items and acquired and partially acquired phonemes in each of the age subrange. The Wilcoxon test showed different percentages of phonemes and produced words only in the subrange group of 1 year and 8 months to 1 year, 11 months and 29 days, with higher production of phonemes (p=0.031). In the other subrange groups, although the phonological component protrudes, there was no significance.

DISCUSSION

Exclusively in the area of phonology, the increasing number of sound produced according to the increasing age was

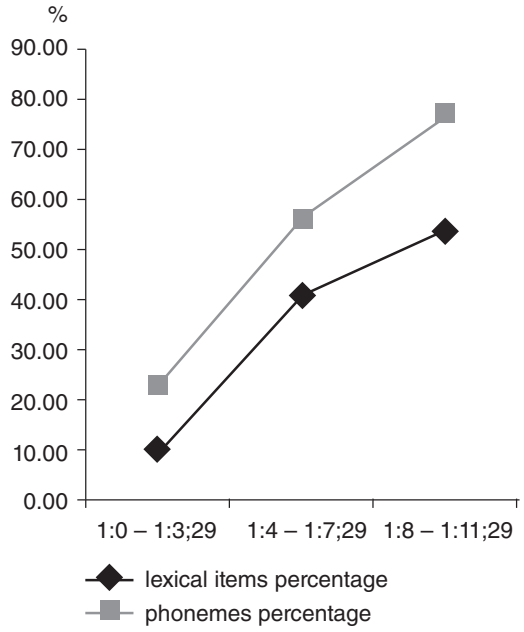

Figure 1. Comparison between lexical and phonemic production

Table 1. Comparison of the percentage means of acquired and partially acquired phonemes within the age subranges

Age subrange	Mean the number of AP	Percentage mean of AP and PAP (%)	p-value
1:0–1:3;29	2.5	22.73[a]	
1:4–1:7;29	6.17	56.06[b]	0.004
1:8–1:11;29	8.5	77.27[b]	

Statistical method used: Kruskal–Wallis test; significance value: $p<0.05$. Superscripted same letters indicate there is no difference between the values; superscripted different letters indicate there is a difference between the values

Caption: AP = acquired phoneme; PAP = partially acquired phoneme

Table 2. Comparison of the percentage averages of lexical items produced within the age subranges

Age subrange	Percentage average of lexical items (%)	p-value
1:0–1:3;29	10.27[a]	
1:4–1:7;29	41.18[b]	0.006
1:8–1:11;29	53.92[b]	

Statistical method used: Kruskal–Wallis test; significance value: $p<0.05$. Superscripted same letters indicate there is no difference between the values; superscripted different letters indicate there is a difference between the values

expected, because the phonological acquisition is a gradual and continuous process[16]. However, when comparing the age subrange 1 year and 4 months to 1 year, 7 months and 29 days with the one of 1 year and 8 months to 1 year, 11 months and 29 days, no statistical significance was observed. According to the studies by Lamprecht et al.[16], in the age period of 1 year and 1 year, 11 months and 29 days, the age range with the highest growth in phoneme production is 1 year and 6 months, a milestone for the acquisition of the initial plosives and nasal sounds. This explains the absence of statistical significance between the last two ranges studied here.

Regarding the number of sounds acquired, the phonology of children in the first age range group overcomes the one of individuals from other researches carried out in Rio Grande do Sul[16]. According to those, up until 1 year and 4 months of age, most children produced only vowels and *glides*, whereas in this research, the average consonants produced was 2.5. This may be explained by the individual variations inherent to the phonological development[16].

In the second age range group, an average of 6.17 produced consonants observed, while in the study being discussed[16], it was found an average of 8 produced consonants. Finally, in the third age group observed, referenced in this same study, it would be expected to find 11 consonants, while the average was 8.5. This difference found between the studies may reflect the socioeconomic status of the studied children. In the aforementioned survey, most children had parents who were university professors, whereas in this study, in general, most parents had low educational and income levels.

The last two groups presented quite similar results to the data presented in a longitudinal study[17]. In the so mentioned work, the child presented six phonemes acquired in the age range between 1 year and 6 months and 1 year and 7 months and nine phonemes in the age range between 1 year and 8 months and 1 year and 11 months. In this research, an average of 6.17 phonemes acquired in the subrange of 1 year and 4 months of age to 1 year, 7 months and 29 days and an average of 8.5 phonemes acquired in the subrange of 1 year and 8 months to 1 year, 11 months and 29 days were found. However, attention should be paid to small differences between these two studies: the first study considered to having been acquired the phonemes correctly produced in more than 85% of the cases, while this study considered a percentage of 80% of correct productions; in the first study, productions in at least one position of the phoneme in the word were considered, while this one considered the data from the overall phonological system of the children; finally, in the first study, the affricate consonants were not considered, whereas this study did consider those consonants.

Within the age groups studied, when comparing the percentages of lexical items, it is observed that it increases in all subranges, though there is a significant growth between the first and the third subranges. This may be explained by the rapid vocabulary growth, where, at the beginning, the words used are to fulfill specific functions, such as, "hi," "bye," "mommy," and "daddy"; from there on, the lexical growth progresses slowly, until, at around 18–24 months of age, there is a vertiginous growth, reaching 50 words in this period[1]. This explosion coincides with a rapid increase of understood and expressed words.

This also suggests that vocabulary growth is closely related to phonological development[18], which may be observed from Figure 1, and in studies in the area[19], pointing to evidences which say that, in general, children with broader vocabulary have more advanced development, performing more phonological distinctions than those who have more restricted vocabularies.

Early in development, the lexical acquisition is restricted based on the phonology of the words, as shown in Figure 1, where phonology stands out to the lexical items produced. This may happen because children seem to find it easier to produce and understand words beginning with phonemes previously presented on their phonological inventory rather than more complex words, limiting then the expressed vocabulary[20].

In general, it may be observed that both domains, phonological and lexical, evolved simultaneously in numerical terms. This may be explained with what was already found in other works[21-23], whose authors suggest that when a lexical representation is activated, it will activate phonological correspondents, which may also occur in the opposite direction, that is, when phonological representations activate lexical ones.

CONCLUSION

From the results, it was possible to conclude that, for the studied children, there are significant gains of both phonemes and words, every 3 months, in the beginning of the linguistic development. Besides that, the phonological and lexical domains occur in a crescent and mutually influencing each other, although there is a certain advantage of the phonological domain over the lexical one.

It is noteworthy that few studies on this theme were found during the research. Thus, we suggest further investigation, with a broader age range, relating lexical development to the typical phonological one, to confirm these results.

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