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# Construct validation of enunciative signs of language acquisition for the first year of life

## *Validação de construção de sinais enunciativos de aquisição da linguagem no primeiro ano*

### Keywords

Risk Factors  
 Language Acquisition  
 Child Development  
 Evaluation  
 Early Intervention

### Descritores

Fatores de Risco  
 Aquisição da Linguagem  
 Desenvolvimento Infantil  
 Avaliação  
 Intervenção Precoce

### ABSTRACT

**Purpose:** To perform the construct validation of enunciative signs of language acquisition for children aged 3 to 12 months. **Method:** The study sample consisted of 94 mother-infant dyads for the analysis of Phase 1 (3-6 months) signs and 61 dyads for the analysis of Phase 2 (7-12 months) signs. Data collection was performed through analysis of the interaction between mothers and infants in play situation recorded in 15-min videos in the predicted phases, with attribution of value types of present or absent to each sign analyzed. The collected data were organized on a spreadsheet and then converted to computer applications for factor analysis. **Results:** Factor analysis indicated the existence of two factors named “mother” and “infant” both for Phase 1 signs (explaining 71.9% of the variation) - with three signs relevant for the “infant” factor and one sign relevant for the “mother” factor, and for Phase 2 signs (explaining 74.4% of the variation) - with one sign relevant for the “infant” factor and one sign relevant for the “mother” factor. **Conclusion:** Construct validation showed that one “mother” factor and one “infant” factor were able to distinguish between at-risk and not-at-risk groups in both phases analyzed, which suggests that the absence of these signs may pose risks to language acquisition.

### RESUMO

**Objetivo:** Realizar a validação de construção dos Sinais Enunciativos de Aquisição da Linguagem para crianças de 3 a 12 meses. **Método:** A amostra contou com 94 díades de mãe-bebê para análise dos sinais da fase 1 (3 a 6 meses) e 61 díades para análise dos sinais da fase 2 (7 a 12 meses). A coleta de dados ocorreu por meio da análise da interação entre mães e bebês em situação lúdica gravada em vídeo nas fases previstas, com atribuição de valor do tipo presente ou ausente a cada sinal analisado em cada fase. Os dados foram organizados em planilha e convertidos para aplicação de software para análise fatorial. **Resultados:** A análise fatorial indicou a existência de dois fatores nomeados “da mãe” e “da criança” na análise da fase 1 dos sinais (explicando 71,9% da variação total), com três sinais relevantes para o fator “da criança” e um sinal relevante para o fator “da mãe”, com relação à fase 2 (explicando 74,4% da variação total), um sinal foi relevante para o fator “da criança” e um para o fator “da mãe”. **Conclusão:** A validação de construção demonstrou que um fator materno e um fator da criança foram hábeis para distinguir grupos de risco e não risco em ambas as fases analisadas, o que sugere que a ausência desses sinais pode indicar risco à aquisição da linguagem.

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## INTRODUCTION

A literature search revealed that, although many instruments for the assessment of language disorders are available for clinical use in the international context, few instruments and models are described in the national literature, especially those designed for the early detection of these disorders<sup>(1,2)</sup>. A Brazilian literature review conducted by Lindau et al.<sup>(2)</sup> evaluated 22 studies on child language that included a total of seven formal assessment instruments lacking statistical validation. Few instruments have assessed children aged <2 years<sup>(3)</sup>, and some studies have investigated spontaneous language production<sup>(4,5)</sup>. There is even greater scarcity of instruments adopting an interactionist paradigm to address child language and adult scaffolding provided to children during the language acquisition process<sup>(6,7,8)</sup>.

This scenario, in addition to the emergence of enunciative studies on language acquisition<sup>(9)</sup>, led to the development of enunciative signs of language acquisition (ESLA), whose content and construct validity were reported by Crestani et al.<sup>(10)</sup>, who presented the results of the judgment of six language acquisition experts on the pertinence of the proposed signs for two age groups (phase 1: 3-6 months; phase 2: 7-12 months) (Chart 1). The enunciative view of language acquisition assumes that adults engage infants in dialogue until the latter can take on their position as speakers<sup>(9)</sup>. These signs aim to promote the early detection of any impairment in language acquisition based on an evidence-based paradigm<sup>(11)</sup>, which means that the absence of ESLA is indicative of the onset of a language symptom, whereas the presence of these signs is a positive finding, showing that language acquisition is occurring appropriately. The ESLA are based on the enunciative proposal<sup>(9)</sup> that attests that infants are supported in the functioning of language by adults until they can acquire knowledge of the language through initial protoconversations and interlocution. Infants will move from adult discursive dependency to independence from the moment they can establish a co-reference and settle in the discourse through double enunciation. Details on the contents of these signs that evidence these mechanisms were explored in the study by Crestani<sup>(10)</sup>.

The proposed ESLA for language assessment in the first years of life greatly differs from what has been found in both recent international clinical studies<sup>(12,13)</sup> and national validation studies of questionnaires to identify children at risk for language acquisition and hearing disorders<sup>(14,15)</sup>. The novelty of these signs derives from their innovative approach to the topic, with a focus on the language functioning of infants when interacting with an interlocutor and not only on their pre-linguistic or grammar skills. Therefore, these signs enable observation of both infants' role in the language acquisition process and the amount of environmental scaffolding they receive from the adults. Such approach is similar to the perspective adopted by some studies that analyzed early interactions between parents and infants and included initial protoconversation in the analysis of both typical and atypical acquisition<sup>(16,17,18)</sup>.

The present study aimed to present the results of the construct validation of ESLA. This procedure evaluates the degree to which the proposed instrument appropriately measures what it

is designed to measure (language acquisition in this case), based on the ability to identify at-risk groups in the sample. To present good construct validity, the instrument should be sufficiently sensitive to demonstrate how many factors it is measuring, as well as the items corresponding to each factor, in the analysis of a statistically significant sample<sup>(16)</sup>.

**Chart 1. Enunciative Signs of Language Acquisition (Source: Crestani et al. (2017))**

Phase I - Items from 3 months to 6 months and 29 days	
1.	The infant reacts to motherese by means of vocalizations, bodily movements, or eye contact.
2.	The infant fills its place in the interlocution with verbal sounds such as vowels and/or consonants (for example, /a, u, i/ or /m, p, t/).
3.	<b>The infant fills its place in the interlocution with non-verbal sounds attuned to the enunciative context (smiling, yelling, crying, coughing, and grumbling).</b>
4.	<b>The infant fills its place in the interlocution quietly, only with bodily movements and looks attuned to the enunciative context.</b>
5.	The infant initiates the conversation or protoconversation.
6.	The infant and mother (or her substitute) exchange looks during interaction (for 3 or more seconds).
7.	<b>The mother (or her substitute) gives meaning to the verbal and non-verbal manifestations of the infant, and supports this protoconversation or conversation when the infant initiates it.</b>
8.	The mother (or her substitute) uses motherese while speaking to the infant attuned to what is happening in context and awaiting the infant's responses.
Phase II - Items from 7 months to 12 months and 29 days	
9.	The infant fills its place in the interlocution (utterance) with verbal sounds (syllables with vowels and various consonants - at least two points and two articulatory modes of consonants, for example, with consonants such as /pa, ta, ma/, etc.).
10.	The infant outlines the production of words by mirroring the mother's (or her substitute's) speech.
11.	<b>The infant outlines the production of protowords spontaneously.</b>
12.	<b>When the mother (or her substitute) is summoned to enunciate by the infant, she reproduces her statement and awaits the infant's response.</b>

**Captions:** Signs considered strong in factor analysis are shown in bold

## METHOD

The present investigation complies with the mandatory ethical regulations for research involving human beings set forth in Resolution 466/12 of the Brazilian National Health Council, and was approved by the Research Ethics Committee of the aforementioned Institution under protocol no. 28586914.0.0000.5346. All individuals involved in this study were informed about its purposes and procedures and agreed to participate in it by signing an Informed Consent Form (ICF).

A construct validation technique was used to develop, evaluate, and improve an instrument composed of the ESLA. The content validation of these signs, reported by Crestani et al.<sup>(10)</sup>, resulted in the experimental version of two age-specific instruments, including the signs shown in Chart 1.

The sample consisted of 94 mothers and infants aged 3 months and 1 day to 6 months and 29 days - a group to which the Phase I instrument was administered, and 61 mothers and infants aged 7 months and 1 day to 12 months and 29 days - a group

to which the Phase 2 instrument was applied. The sample size per phase was defined by the number of signs multiplied by 10.

The dyads were recruited from Primary Health Care units in the municipality of Santa Maria, state of Rio Grande do Sul, Brazil, when the infants were one month old and underwent the neonatal heel prick test.

Infants with evident signs of neurological impairment, malformations and syndromes, preterm, and those with visual or hearing impairment, i.e., any abnormalities that could affect communication, were excluded from the study. Mothers with suspected disease causing very impaired psychic structure, such as psychosis or schizophrenia, were also excluded from the study. Therefore, inclusion criteria were term infants with no diagnosis of biological abnormalities.

Considering that all participants were recruited at a child care service, all infants were examined by pediatricians, who informed any biological abnormality or referred the infant to a neurologist whenever necessary. When there was doubt about mother's psychic status, she was referred to the psychologists of the team. Cases requiring treatment were referred to the university multidisciplinary center of early detection and intervention. When the infants meeting the inclusion criteria reached the appropriate age for the administration of the ESLA instrument, the mothers were contacted to schedule a visit intended to assess the mother-infant interaction.

All mother-infant dyads were observed, during data collection, by a multidisciplinary team of speech-language pathologists, occupational therapists, physical therapists, and psychologists belonging to the same research group. Data from eligible dyads were obtained through an initial interview lasting 15 min, on average, conducted by the research team. If this interview revealed that the infant met the age criteria for the study and there were favorable conditions for possible observation of mother-infant interaction, the corresponding ESLA instruments were administered for analysis according to the infant's age (Phases 1 or 2).

Considering the dynamics and the facilitation of this interaction, as well as the possibility of observing the mother-infant interaction with no third parties present, interactions were video recorded from a long distance, so as to interfere as little as possible with the dyad relationship.

At this point, mothers were invited to sing, talk to, and play with their infants using rubber toys, enabling plays related to transportation, house, animals, etc., stored in a toy box. The examiner proposed that mothers interacted with their infants the same way they did at home. Video recordings lasted 15 min, on average, and were performed in a quiet room using two cameras placed on tripods. One camera was placed laterally, one meter away from the dyad, and captured the faces of both mother and infant, whereas the other camera was placed frontally at a distance of 2 m. In the case of infants aged 3-6 years, the latter camera captured a frontal view of infant's face and mother's face was captured through a mirror, because the infants were sitting on a baby seat facing their mothers and with a mirror behind them. Both mothers and infants remained on an EVA mat. The infants aged 7-9 months were allowed to move freely on the EVA mat and play with the toys together with their mothers,

depending on their motor skills to sit and crawl. Based on the video recordings, infants aged 3 months and 1 day to 6 months and 29 days were assessed using the Phase 1 instrument, and those aged 7 months and 1 day to 9 months and 29 days were evaluated using the Phase 2 instrument. Observations made during the initial interview were also taken into account in this assessment to assist with verifying the video recordings. Data on the presence and absence of signs at all ages studied were used for factor analysis, which aimed to determine which signs better distinguish between at-risk and not-at-risk groups regarding the development of language disorders.

Results of the administration of ESLA instruments to the dyads were organized on a spreadsheet and then converted to STATISTICA 9.1 and PASW 17.0 software for multivariate analysis – factor analysis at a 5% significance level. The Kaiser-Meyer-Olkin (KMO) coefficient and the Bartlett's test of sphericity were used to test data suitability to factor analysis.

## RESULTS

The factors that compose the two instruments in the construct validation of ESLA were identified using multivariate analysis – factor analysis at a 5% significance level.

Figure 1 illustrates the results of the factor analysis for Phase 1 signs.

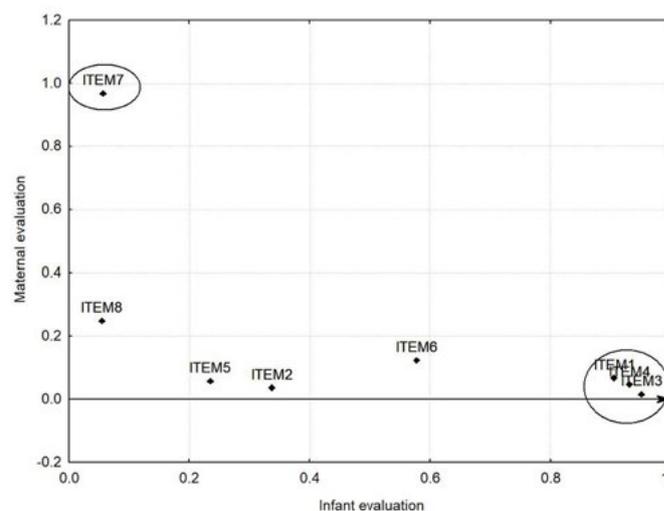


Figure 1. Factor analysis of signs from the Phase 1 instrument

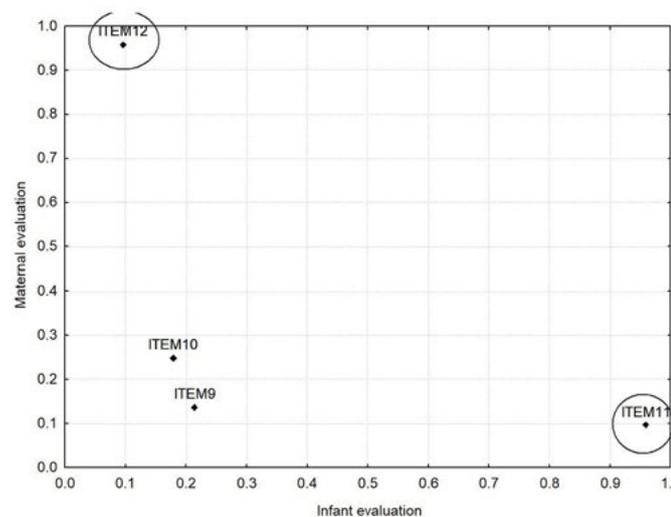
The Kaiser-Meyer-Olkin (KMO) coefficient of the Phase 1 (3 months and 1 day to 6 months and 29 days) instrument was 0.76, demonstrating that these items exhibit moderate suitability to factor analysis, and the Bartlett's test of sphericity (653.3;  $p < 0.01$ ) indicated that there was sufficient correlation between the variables.

Factor analysis of the Phase 1 instrument revealed the existence of two factors that explained 71.9% of the variation. Factor analysis with Varimax rotation showed that three variables (items) were relevant to Factor 1, namely, items 3, 4 and 1, in this order of importance, and that one variable (item 7) was relevant to Factor 2.

Factor 1 presented eigenvalue  $\lambda=4.2$  and explained 53.9% of the variation, representing the evaluation of infant's interaction. This factor was composed, according to the order of importance determined by the factor loadings shown in parentheses, of the following items: 3 (0.952) - The infant fills its place in the interlocution with nonverbal sounds attuned to the enunciative context (smiling, yelling, crying, coughing, grumbling); 4 (0.932) - The infant fills its place in the interlocution quietly, only with bodily movements and looks attuned to the enunciative context; 1 (0.906) - The infant reacts to motherese through vocalization, bodily movements, or eye contact.

Factor 2 presented eigenvalue  $\lambda=1.0$  and explained 14.4% of the variation, representing the evaluation of the mother's interaction. This factor was composed of item 7 (0.992) - The mother (or her substitute) gives meaning to the infant's verbal and non-verbal manifestations and supports this protoconversation or conversation when the infant initiates it.

Figure 2 illustrates the results of the factor analysis for Phase 2 signs.



**Figure 2.** Factor analysis of signs from the Phase 2 instrument

The KMO coefficient of the Phase 2 (7 months and 1 day to 9 months and 29 days) instrument was 0.71, demonstrating that these items exhibit moderate suitability to factor analysis, and the Bartlett's test of sphericity (45.2;  $p<0.01$ ) indicated that there was sufficient correlation between the variables.

Factor analysis of the Phase 2 instrument revealed the existence of two factors that explained 74.4% of the variation. Factor analysis with Varimax rotation showed that only one variable (item 11) was relevant to Factor 1, and one variable (item 12) was relevant to Factor 2.

Factor 1 presented eigenvalue  $\lambda=2.2$  and explained 54.1% of the variation, representing the evaluation of the infant's interaction. This factor was composed of item 11 (0.959) - The child outlines the production of protowords spontaneously.

Factor 2 presented eigenvalue  $\lambda=0.8$  and explained 20.3% of the variation, representing the assessment of the mother's interaction. This factor was composed of item 12 (0.959) - When the mother (or her substitute) is summoned to enunciate by the child, she reproduces her statement and awaits the infant's response.

## DISCUSSION

It is worth emphasizing that the factor analysis showed that the infants' conditions and the adults' investment in the interlocution with them created two distinct factors in both instruments: one associated with the infant and other with the adult. This explains the relevance of the enunciative perspective for the study of language acquisition.

Silva<sup>(9)</sup> proposes that the I-you relationship is essential for the analysis of language acquisition, which was clearly reflected in the results reported here due to the fact that factor analysis identified one factor describing the I-infant factor (Factor 1) and one factor describing the you-adult factor (Factor 2). This indicates that not only the infants' conditions but also the investment that adults make in the interlocution with them is essential in the language acquisition process, which confirms the initial hypothesis suggested by Crestani<sup>(10)</sup>: dialogue is an important unit of analysis in language acquisition because it enables observation of the enunciative scaffolding provided by adults to assist infants with building grammar knowledge and a place in speech.

The variables identified as relevant in the factor analysis of the Phase 1 instrument for the infant element, i.e., the infants' reactions to motherese and the non-verbal expression of their demands, whether sound or silent, attuned to the enunciative context (items 1, 3, 4), were those showing that the infants have an appetite for protoconversation and, combined with the adults' investment (item 7), suggest absence of risk of language acquisition. This result reinforces the importance of initial protoconversation, supporting previous studies on at-risk populations<sup>(6,7,8)</sup> as well as on typical acquisition<sup>(9)</sup>.

In this context, the present study brought statistical evidence to the findings by Krueger et al.<sup>(19)</sup>, indicating that there are more types of speech directed to infants other than motherese, and that harmony in protoconversation may be the essential factor demonstrating that language acquisition is occurring appropriately. These authors propose interpretancy and homology as the principles of protoconversation analysis in the first six months of life to indicate that the adults are actively adapting to the infants. The present study confirms this idea, because homology and interpretancy occur through non-verbal sounds and gestures reported in items 3, 4 and 7 of the Phase 1 instrument, as advocated by Krueger et al.<sup>(19)</sup>.

Results of the present study also corroborate the ideas of Verly and Freire<sup>(8)</sup>, who proposed the indicator 2, related to parents verbally interpreting the bodily manifestations of their child, for the constitution of a speaking individual.

Conversely, in Phase 2, the spontaneous production of protowords (item 11) and the adults' investment in interlocution (item 12), thus acknowledging the infants as interlocutors, are key elements in the language acquisition process. This fact reminds us that principles of both form-meaning relationship and intersubjectivity are reflected in these two items and provide support for the enunciative proposal of language acquisition<sup>(9)</sup>.

The form-meaning relationship occurs in the production of a sign showing that infants do not master form and then master content; therefore, it is not possible to believe that repeating the

adults' speech is an essential strategy for language acquisition. The Infants' attempt to spontaneously produce signs, even in the form of protowords, shows that they are trying to simultaneously master form and meaning, and that they fill their place in the interlocution in their interaction with the addressee, a place that makes infants spontaneously invest in dialogue.

This can also be observed in the principles proposed by Verly and Freire<sup>(8)</sup> based on the analysis of cases of language disorders, which address the infants' initiative of spontaneously producing speech without depending on others and their interest in dialoguing. It is worth noting that the resources to which children have access will differ in each evolutionary stage and that, in the stage studied here, the production of protowords seems to provide a more specific qualification of the possible type of investment in interlocution than the indicators proposed by Verly and Freire<sup>(8)</sup>, which were not separated by age because they were based on the analysis of a broad age group (2 to 6 years old).

Additionally, one can state that the inclusion of item 11 as relevant shows that intersubjectivity is inherent in language functioning. This principle is also reflected in item 12, in which the adult is summoned to enunciate by the infant, and she reproduces her statement and awaits the infant's response. Therefore, two linguistic principles have proved to be important in the ESLA concept: intersubjectivity and form-meaning relationship. This finding corroborates the results of Flores and Souza<sup>(20)</sup>, who found that the linguistic performance of children at risk of development of language disorders at 24 months of age was influenced by the presence of different addressees in the interlocution. Their study also found that the distinction between grammar mastery and the process of language semantization (principle of form-meaning relationship) identified this performance with greater accuracy, i.e., children may master linguistic form, but linguistic use may be precarious depending on their relationship with the interlocutor (intersubjectivity principle)<sup>(20)</sup>.

It is worth highlighting that sign 11 deals not only with the production of the ESLA, but also with the fact that it is spontaneous, which means that infants are able to simultaneously articulate the semiotic domain and the language semantization process, and thus to act as speakers. However, the adult needs to address the infant as a speaker and sustain a dialogue (sign 12), so that this ability can be developed.

This valuation of dialogue in language analysis is also reflected in the axes for the constitution of a speaking individual proposed by Verly and Freire<sup>(8)</sup>; two of these axes are related to the assumption and recognition of infants as speakers. The indicators proposed by these authors, especially the four first ones, are related to the parents' attitude towards their infants' productions, particularly the valuation and investment in supporting interlocution and insertion of these productions into more complex linguistic contexts<sup>(7)</sup>.

## CONCLUSION

Construct validation showed that in both instruments used to assess the enunciative signs of language acquisition, two factors were relevant to distinguish between at-risk and not-at-risk groups regarding the development of language disorders after

factor analysis: one associated with the infant and other with the mother. Factor analysis identified four items of the Phase 1 instrument (3-6 months): three related to the "infant" factor and one to the "mother" factor; and two items of the Phase 2 instrument (7-12 months): one related to the "mother" factor and other to the "infant" factor, whose absence can be determining for the risk of development of language disorders.

The emergence of two factors, one related to the mother and other to the infant, suggests that the enunciative perspective, which considers the interlocution as the element of analysis, is a promising approach to detect risk of language acquisition. A further study addressing the analysis of language outcomes of children lacking signs of language acquisition may contribute to a better understanding of the sensitivity and specificity of the two ESLA instruments.

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**Author contributions**

*AHC was responsible the study design, participated in the collection, analysis and interpretation of data and writing of the manuscript; ABM was the study co-adviser and participated in the statistical analysis; ADM participated in the statistical analysis; APRS was the study adviser, participated in the study design, analysis and interpretation of data, and writing of the manuscript.*