

IMPACT OF SPEECH SOUND DISORDERS ON PREDICTIVE LITERACY SKILLS IN SOCIALLY VULNERABLE CONTEXT

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Abstract

Introduction: The context of social vulnerability can intensify phonological and linguistic deficits, compromising the development of skills predictive of literacy, such as vocabulary and metaphonological skills, phonological working memory, and speed of access to mental lexicon, and consequently, academic performance. **Aims:** The aims of this study was to characterize and compare the performance of schoolchildren with and without speech sound disorder in socially vulnerable context in predictive literacy skills. **Materials and Methods:** 31 students from the 1st and 2nd grades of Elementary School participated in this study, divided and classified according to the degree of severity speech sound disorders. Group I (GI) is composed by 14 students with speech sound disorders, and Group II (GII) composed by 17 students without speech sound disorders. All participants in this study attended, outside of regular school hours, a Non-Governmental Organization (NGO) located in the central-west region of São Paulo State, which serves children in socially vulnerable context. **Results:** The results of this study demonstrated that the interference of speech sound disorders was only observed in one of the predictive skills for literacy, the speed of access to the mental lexicon. **Conclusion:** Based on the findings of this study, it is not possible to conclude that speech and reading have partially distinct origins, since an important predictive skill for literacy, and consequently for reading, the speed of access to the mental lexicon, was the skill that proved most susceptible to the presence of speech sound disorders.

Keywords: *Learning, social vulnerability, speech sound disorders, predictors of literacy.*

1. Introduction

Social vulnerability is defined as a condition of risk or fragility of a population in the face of essential resource limitations, such as education, health, and basic services, which increases the susceptibility of the population to social and economic difficulties (Instituto de Pesquisa Econômica Aplicada, 2018). The scarcity of linguistic stimuli and limited family support in this context can worsen phonological and linguistic deficits, compromising the development of predictive literacy skills, such as vocabulary and metaphonological skills, phonological working memory, and lexicon access speed (Wagner & Torgesen, 1987), and, consequently, academic performance.

The development of linguistic and academic skills depends on the integration of multiple biological, cognitive, and environmental factors. Students who have difficulties in acquiring these skills tend to experience difficulties in oral language and learning, which can be further compromised in the presence of speech sound disorders (SSDs). SSDs are characterized by difficulties in producing speech sounds due to perception, production, or phonological organization difficulties, which directly impact the processes involved in the acquisition and consolidation of the linguistic skills necessary for obtaining literacy (Wertner, Pulga & Pagan-Neves, 2014; Capellini, Kerges-Alcantara & Xavier, 2024).

Considering that the presence of SSDs can cause changes in the formation, retention and recall of phonological sequences—affecting not only speech but also language and the academic learning process, especially in a country that has an alphabetic-based writing system, such as Brazilian Portuguese—such changes may interfere with the acquisition of graphophonemic (reading) and phonographemic (writing) conversion mechanisms, which are essential for the development of reading and writing (Capellini et al., 2024; Oliveira & Capellini, 2020).

Thus, the central goal of this study is to determine whether the presence of speech sound disorders can affect the development of predictive literacy skills, given a lack of consensus in the literature regarding whether a continuum between speech development and the development of reading, one of the skills of the literacy process, exists.

2. Objectives

The objective of this study was to characterize and compare the performance of schoolchildren with and without speech sound disorder in socially vulnerable context in predictive literacy skills.

3. Methods

This study was approved by the Research Ethics Committee of the Faculty of Philosophy and Sciences of the São Paulo State University “Júlio de Mesquita Filho” - FFC/UNESP - Marília-SP, under number 83015624.8.0000.5406.

Initially, 31 male and female schoolchildren aged between 6 years and 7 years and 11 months who were regularly enrolled in the 1st and 2nd years of elementary school participated in this study. All initially included students participated in a nongovernmental organization (NGO) program located in the centre-west of São Paulo, which serves children in socially vulnerable situations.

Initially, the students were asked to complete the Naming Test portion of the Andrade-Béfi-Lopes-Fernandes-Wertzner (ABFW) Child Language Test (Andrade, Befi-Lopes, Fernandes & Wertzner, 2000), an instrument used to evaluate the phonological and lexical abilities of Brazilian schoolchildren, to characterize their phonetic inventories and investigate the occurrence of phonological processes. After test completion, the oral responses were recorded and transcribed phonetically on the recording sheets according to the analytical criteria proposed by the authors. Next, the phonological processes present in the students' vocalizations were identified. To quantify these productions of speech sounds, the Percentage of Correct Consonants – Revised (PCC-R) analysis was used, according to the criteria of Shriberg, Austin, Lewis, McSweeney and Wilson (1997). This analysis was applied to determine the degree of speech sound disorder severity.

Based on the values obtained from the PCC-R analysis, in accordance with the criteria of Shriberg et al. (1997), the 31 students in this study were divided into groups according to the degree of SSD severity, as shown in Table 1; Group I (GI) consisted of 14 students with SSDs, and Group II (GII) consisted of 17 students without SSDs.

Table 1. Characterization of the degree of severity of the SSDs of the students in this study.

Variable	Category	Group				p value
		I		II		
		Freq.	Perc.	Freq.	Perc.	
PCC-R	1	8	57.10%	0	0.00%	< 0.001*
	2	4	28.60%	0	0.00%	
	3	1	7.10%	0	0.00%	
	4	1	7.10%	0	0.00%	
	5	0	0.00%	17	100.00%	

Caption: GI: students with speech sound disorders, GII: students without speech sound disorders, category 1: mild degree; category 2: mild-moderate degree; category 3: moderate-severe degree; category 4: severe degree; and category 5: no SSDs.

The characterization of the typology of altered phonological processes in students with speech sound disorders, based on the severity index, is presented in the table. The 8 students who presented a mild degree of SSD severity (57.10%) used gliding of liquids, consonant cluster reduction, final consonant deletion, and sound distortions (others) in their speech.

After the characterization of the population sample of this study, tests that measured the predictive literacy skills were applied. The Vocabulary Tests of the ABFW Child Language Test (Andrade et al., 2000) were applied to evaluate the expressive lexical repertoire; the Word and Pseudoword Repetition Test (Seabra & Dias, 2012) was used to measure short-term phonological memory; and the Phonological Awareness Test by Oral Production (Seabra & Dias, 2012) was used to assess the ability to reflect and manipulate speech sounds; the Digit Span task of the Cognitive Neuropsychological Assessment (Dias & Mecca, 2012) was used to measure working memory; and the Automatic Naming Test (TEste de Nomeação Automática, TENA) (Silva, Mecca & Macedo, 2018) was used to assess the speed of lexical access.

The collected data were statistically analysed using SPSS Statistics (Statistical Package for the Social Sciences), version 26.0, with a significance level of 5% (0.050) indicated by an asterisk in the tables.

Table 2. Classification of the students in GI and GII on the basis of their performance on the ABFW Vocabulary Test.

GI					GII			
Classification	Category	Freq	Perc	p value	Category	Freq	Perc	p value
DUW	1	13	92.90%	0.311	1	15	88.20%	0.062
	2	1	7.10%		2	2	11.80%	
ND	1	12	85.70%		1	10	58.80%	
	2	2	14.30%		2	7	41.20%	
SP	1	10	71.40%		1	15	88.20%	
	2	4	28.60%		2	2	11.80%	

Caption: *: $p \leq 0.05$ - Cochran test; 1: within normal range; 2: below normal; DUS: designation by usual word; ND: nondesignation; PS: substitution process.

4. Results and discussion

According to the Cochran test, there was no statistically significant difference in the performance class of the students in GI and GII according to the expressive lexical repertoire from the ABFW Vocabulary Test (Table 2), indicating that the presence of speech sound disorders in GI students did not interfere with their development and performance of expressive vocabulary.

In this study, the students performed similarly on the vocabulary test regardless of whether they had speech sound disorders, which is in agreement with the literature (Brancalioni, Marini, Cavalheiro & Keske-Soares, 2011) and indicates that children with SSDs performed similarly to their peers in the same age group. Thus, the semantic abilities of children with speech sound disorders allow verification of the extent of the alterations and can be considered an exclusion factor of more comprehensive language or learning disorders in this population. Given that the majority of the population in this study with speech sound disorders presented a mild degree of severity, it is possible to consider this a decisive aspect for their good lexical performance.

The results of the Wilcoxon signed-rank test indicate a statistically significant difference in the times and errors of students in GI and GII on the rapid automatic naming of objects and letters tests (table 3).

Table 3. Comparison of the times and errors of GI and GII students in taking the Automatic Naming Test (TENA).

GI					GII			
	N	Mean	Standard deviation	p value	N	Mean	Standard deviation	p value
RAN-C	14	3.36	0.75	0.190	17	3.18	1.07	0.491
RAN-CE	14	3.79	0.80		17	3.47	0.72	
RAN-O	14	3.29	1.07	0.011*	17	2.76	0.56	0.009*
RAN-OE	14	4.50	0.76		17	3.88	1.17	
RAN-L	14	3.57	1.22	0.040*	17	3.41	0.94	0.204
RAN-LE	14	4.29	1.07		17	3.76	1.09	
RAN-N	14	3.50	1.09	0.098	17	3.41	1.06	0.100
RAN-NE	14	3.93	1.00		17	3.82	0.88	

Caption: *: $p \leq 0.05$ - Wilcoxon signed-rank test; RAN-C: rapid automatic naming of colours-time naming; RAN-CE: rapid automatic naming of colours-errors; RAN-O: rapid automatic naming of objects-time; RAN-OE: rapid automatic naming of objects-errors; RAN-L: rapid automatic naming of letters-time; RAN-LE: rapid automatic naming of letters-errors; RAN-N: rapid automatic naming of numbers-time; RAN-NE: rapid automatic naming of numbers-errors.

The Table 4 shows a comparison of the Metaphonological skills and Phonological Working Memory skills of the GI and GII students.

Table 4. Comparison of the Metaphonological skills and Phonological Working Memory skills of GI and GII students.

Skills	Group	N	Mean	Standard deviation	p value
PWS	GI	14	2.79	0.70	0.541
	GII	17	2.59	1.18	
	Total	31	2.68	0.98	
DS – D	GI	14	3.50	0.76	0.070
	GII	17	3.00	0.61	
	Total	31	3.23	0.72	
DS – I	GI	14	3.64	0.93	0.454
	GII	17	3.41	0.80	
	Total	31	3.52	0.85	
MPS	GI	14	3.43	0.76	0.439
	GII	17	3.18	0.81	
	Total	31	3.29	0.78	

Legend: * = $p \leq 0.05$ - Mann–Whitney U test; MPS: Metaphonological skill; PWS: pseudoword span; DS-D: digit span-direct order; DS-I: digit span- indirect order.

According to the results of the Mann–Whitney U test, there was no statistically significant difference in the performances of the GI and GII students in terms of Metaphonological skills and Phonological Working Memory Skills.

These skills are intrinsically related to vocabulary and the beginning of speech and language development (Hoff, Core & Bridges, 2008). The similar performance between the groups regarding the domain of metaphonological skills and phonological working memory reveals that the presence of the disorder in the students did not compromise the functioning of the generative memory mechanism responsible for the ability to reflect on and manipulate syllables and phonemes. (Silva & Capellini, 2019; Xavier & Capellini, 2025).

The only data from this study that indicate that the presence of speech sound disorders interferes in the performance of predictive literacy skills are the results of the test of the speed of access to the mental lexicon. Students in GI performed differently from those in GII, with a greater number of errors in the rapid naming of letters, indicating that the presence of speech sound disorders hindered the recognition and, consequently, the naming of letters. This in turn indicates that letter knowledge and alphabet recognition skills may be impaired, thus interfering with the acquisition of the grapheme-phoneme conversion mechanism, as described in the literature (Silva & Capellini, 2019).

An important point to consider in this study is that school-aged children, especially older students, generally do not present with severe speech disorders (Shriberg & Mabie, 2017), as evidenced in this study. Therefore, information about past speech development could contribute to a better understanding of the condition (Madsen, 2020). However, since the students were in situations of social vulnerability, it was difficult to contact families for more in-depth and specific research on child development milestones. A recent study in Brazil (Mah, Penwarden, Pott, Theou & Andrew, 2023) reported that children in situations of economic vulnerability face greater threats to their full development, highlighting the need for public interventions aimed at socioeconomic improvements that guarantee a more favorable developmental environment in early childhood.

5. Conclusion

Based on the findings of this study, it is not possible to conclude that speaking and reading have partially distinct origins (Michaelides & Luciano, 2023), since the speed of access to the mental lexicon, which is an important predictor of literacy and consequently of reading, was most susceptible to the presence of speech sound disorders.

According to the literature (Santos & Capellini, 2020; Stappen, Dricot & Reybroeck, 2020), necessary processes are performed during rapid automatic naming (RAN) as well as at the time of reading, revealing the direct relationship of one skill with the other. These processes include attention to stimulus; activation of the visual processes (discriminating and identifying the tracing of the letter and its pattern); integration of this visual information with the storage of orthographic representations and phonological representations; and integration of this information with semantic questions and motor activation for articulation.

However, as SSDs were only observed to interfere in performance of one of the predictive literacy skills, future work should expand upon this study by broadening the observations to the reading and writing skills in an attempt to show differential patterns of influence not only of SSDs but also of the social context and the mastery of predictive skills for literacy in academic contexts (Hayiou-Thomas, Carrol, Leavett, Hulme & Snowling, 2017).

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