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RESEARCH REPORT

PERCEPTUAL ANALYSIS OF **TEACHERS' SPEECH EXPRESSIVENESS** AFTER SPEECH-LANGUAGE INTERVENTION

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ABSTRACT

This study aimed to analyze the effects of a speech-language intervention on speech expressiveness based on perceptual data of voice quality and vocal dynamics in teachers from a state public school in Paraíba, Brazil. The study was based on the phonetic model of voice quality description and used the Vocal Profile Analysis for Brazilian Portuguese (VPA-PB). This protocol allows a detailed analysis of vocal tract, laryngeal, and muscle tension settings, as well as prosodic elements, to describe the speaker's voice quality and vocal dynamics. This interventional, qualitative-quantitative study was approved by the Human Research Ethics Committee of the Federal University of Paraíba (Certificate of Submission for Ethical Review – CAAE nº 65750222.1.0000.5188). Four teachers from a state military school in João Pessoa participated in the study, attending four

weekly theoretical-practical workshops that addressed breathing, articulation, pitch and intensity modulation, resonance, and vocal warm-up. Speech samples (VPA-PB sentences and classroom context) were collected before and after the intervention and analyzed by three expert judges. Preliminary results showed a reduction in laryngeal and vocal tract hyperfunction, a decrease in raspy voice, increased pitch and loudness variability, and improved respiratory support, indicating improvements in voice quality and speech expressiveness. These findings suggest that the intervention effectively promoted more balanced vocal settings and greater expressive flexibility, resulting in more natural and efficient speech production with reduced phonatory effort.

ABSTRACT

O objetivo deste estudo foi analisar os efeitos de uma intervenção fonoaudiológica na expressividade da fala de professores, a partir de dados perceptivos de qualidade e dinâmica vocal. A pesquisa baseou-se no Modelo Fonético de Descrição da Qualidade Vocal e utilizou o protocolo Vocal Profile Analysis for Brazilian Portuguese (VPA-PB), instrumento que permite a análise dos ajustes do trato vocal, da laringe, da tensão muscular e dos aspectos prosódicos, possibilitando descrever a qualidade e a dinâmica vocal dos participantes. Trata-se de um estudo intervencional, de abordagem qualitativo-quantitativa, aprovado pelo Comitê de Ética em Pesquisa com Seres Humanos da Universidade Federal da Paraíba (CAAE nº 65750222.1.0000.5188). Participaram quatro professores de uma escola militar estadual da cidade de João Pessoa, Paraíba. Foram realizadas quatro oficinas teórico-práticas semanais, abordando respiração, articulação, modulação de frequência e intensidade, ressonância e aquecimento vocal. Amostras de fala, compostas por frases do protocolo VPA-PB e registros em contexto de sala de aula, foram coletadas antes e após a intervenção e analisadas por três juízes especialistas. Os resultados preliminares evidenciaram redução da hiperfunção laríngea e do trato vocal, diminuição da voz áspera, aumento da variabilidade de pitch e loudness e melhora do suporte respiratório. Tais achados indicam aprimoramento da qualidade vocal e da expressividade da fala. Conclui-se que a intervenção contribuiu para ajustes vocais mais equilibrados, maior flexibilidade expressiva e uma produção de fala mais natural e eficiente, com redução do esforço fonatório durante a comunicação docente.

KEYWORDS

Teachers; Prosody; Auditory Perception; Expressiveness Training; Voice.

PALAVRAS-CHAVE

Docentes; Prosódia; Percepção Auditiva; Treinamento da Expressividade; Voz.

INTRODUCTION

Oral communication is one of the main mediating tools in the teaching–learning process. Hence, voice and speech expressiveness play a central role in teachers' professional practice (Lima-Silva *et al*., 2024). Speech expressiveness involves the integrated use of prosodic, articulatory, vocal, and nonverbal elements that contribute to message clarity, the maintenance of students' attention, and the construction of meaning in the classroom (Barbosa *et al.,* 2021). Thus, teachers, as communication professionals, rely on the effective use of these resources to facilitate content comprehension and student engagement.

However, factors related to working conditions, vocal overload, and school organization make teachers particularly vulnerable to the development of voice disorders, which may compromise both vocal quality and speech expressiveness (Pereira *et al.,* 2025). Vocal alterations often result in more restricted prosodic patterns, reduced pitch and loudness variability, and increased phonatory effort, negatively affecting pedagogical communication and students' attention (Rodrigues; Medeiros; Teixeira, 2017).

Hence, studies have proposed speech-language interventions to promote vocal health and improve teachers' functional voice use (Rufino *et al.,* 2025; Lima-Silva *et al.,* 2024; Pereira *et al*., 2025). Research indicates that programs including speech expressiveness training may promote more balanced vocal settings, increase prosodic flexibility, and improve teachers' communicative performance (Ferreira *et al.,* 2022). Nevertheless, few studies have systematically investigated changes in speech expressiveness following speech-language interventions, particularly those employing specific phonetic-perceptual instruments.

Within this perspective, the Vocal Profile Analysis for Brazilian Portuguese (VPA-PB) stands out as an auditory-perceptual evaluation protocol capable of describing voice quality settings and vocal dynamics, encompassing laryngeal, supralaryngeal, muscle tension, and prosodic aspects (Camargo; Madureira, 2008a; Laver; Mackenzie-Beck, 2007). This protocol maps vocal production patterns and potential changes in speech expressiveness in professional voice users, including teachers.

This phonetics research report is grounded in the phonetic model for the description of voice quality proposed by John Laver (1980), employing the VPA protocol to analyze the effects of a speech-language intervention on the speech expressiveness of teachers from a state public school in Paraíba, Brazil. Specifically, the study aims to (a) describe voice quality and vocal dynamics settings before and after the intervention; and (b) examine the applicability of the VPA-PB for monitoring speech expressiveness in teachers' communication.

This study hypothesized that the speech-language intervention would promote more balanced vocal settings, with a reduction in hyperfunctional patterns and greater prosodic variability. Considering the scarcity of studies that integrate teachers' speech expressiveness, speech-

language intervention, and auditory-perceptual evaluation using the VPA-PB, this research seeks to contribute to the advancement of discussions on teachers' communicative development and on the application of phonetic-perceptual instruments in the evaluation of speech expressiveness.

This article is organized as follows: Section 1 presents the theoretical framework supporting the study, divided into two main topics; Section 2 describes the methodological procedures; Section 3 presents the results and discussion; and Section 4 provides the final considerations, followed by the references.

1. THEORETICAL FRAMEWORK

This section is divided into two parts: (1) Teachers' speech expressiveness and speech-language intervention; and (2) auditory-perceptual evaluation of voice using VPA-PB.

1.1. TEACHERS' SPEECH EXPRESSIVENESS AND SPEECH-LANGUAGE INTERVENTION

Speech expressiveness is a fundamental component of human communication and plays a central role in teachers' professional performance. As communication professionals, teachers rely on the integration of speech, voice, and body language to convey content, mediate interactions, and support the construction of meaning in the classroom (Lima-Silva; Penha; Chieppe, 2021; Pecorari; Kyrillos, 2021). Thus, the way teachers express themselves directly influences students' attention, comprehension, and engagement, making expressiveness a strategic resource in the teaching–learning process (Ferreira; Arruda; Marquezin, 2012; Pecorari; Kyrillos, 2021).

Speech expressiveness is closely related to prosodic aspects of communication, such as intonation, rhythm, pauses, speech rate, pitch variation, vocal intensity, voice quality, and articulation of speech sounds (Barbosa *et al.,* 2021). These elements structure discourse, highlight relevant information, and enable speakers to convey intentions, attitudes, and emotions, making communication clearer and more effective (Madureira, 1992). The appropriate use of these resources in education enhances pedagogical mediation, helps maintain students' attention, and conveys confidence and motivation during classroom activities (Ferreira; Arruda; Marquezin, 2012).

Conversely, vocal alterations and prosodic imbalances may compromise teachers' expressiveness, resulting in more monotonous speech with reduced communicative impact (Pecorari; Kyrillos, 2021). In such situations, students may need to exert greater cognitive effort to understand the content, which can negatively affect attention and learning (Rodrigues; Medeiros; Teixeira, 2017).

In this context, speech-language interventions aimed at improving speech expressiveness have shown positive outcomes in teachers' vocal and communicative performance. Programs that include vocal training, expressive reading, pitch and loudness modulation, the use of pauses, and

articulatory settings have been associated with perceptual and acoustic improvements in speech, making it clearer, more dynamic, and more effective in pedagogical contexts (Penha *et al.,* 2021; Cordeiro; Tozzo; Ferreira, 2021). Studies report improvements in frequency modulation, articulation, vocal emission stability, and voice projection following interventions designed to enhance teachers' communication.

In the field of voice assessment, VPA-PB has emerged as a relevant instrument for describing voice quality and speech dynamics (Laver *et al.,* 1981; Camargo; Madureira, 2008b; Laver; Mackenzie-Beck, 2007). Based on the phonetic model proposed by John Laver (1980), VPA-PB enables the analysis of laryngeal and supralaryngeal settings and prosodic aspects such as pitch, loudness, pauses, and speech rate.

Studies with teachers using VPA-PB have identified setting patterns associated with voice disorders, including laryngeal hyperfunction, pharyngeal constriction, raspy voice, and changes in vocal dynamics, such as increased pitch and loudness and reduced melodic variability (Lima-Silva, 2012; Azevedo, 2024; Alencar, 2025; Fernandes *et al*., 2025). These findings suggest that the instrument can support the characterization of voice and the development of interventions aimed at improving expressiveness and reducing vocal loading.

Thus, speech-language interventions focused on the development of speech expressiveness can contribute significantly to improving teachers' communication, promoting vocal health, and enhancing the teaching–learning process.

1.2. AUDITORY-PERCEPTUAL EVALUATION OF VOICE USING VPA-PB

Phonetics is dedicated to the study of speech sounds, considering their production, organization, and perception, encompassing the process from speech emission to its auditory processing by the listener (Barbosa *et al.,* 2021). In this sense, speech sound is not limited to the motor act of the speaker but also constitutes a physical and perceptual phenomenon.

The field of voice assessment has developed several auditory-perceptual instruments, predominantly focusing on the glottal source, such as the GRBAS (Hirano, 1981) and GRBASI scales (Dejonckere; Lebacq, 1996). However, vocal alterations may involve not only phonation but also articulatory, resonatory, and respiratory settings, dimensions that these instruments do not always address (Lima-Silva, 2012; Dantas, 2022; Fernandes *et al.,* 2025). In this context, instruments that consider the entire vocal tract, such as VPA, expand the understanding of the global functioning of speech.

This research is grounded in the phonetic model for the description of voice quality proposed by John Laver (1980), which describes voice based on the interaction between physiological, acoustic, and perceptual aspects. Within this model, voice quality results from the relationship between glottal source settings and modifications in the vocal tract (Laver; Mackenzie-Beck, 2007).

VPA was developed based on this perspective and later adapted for Brazilian Portuguese as VPA-PB by Camargo and Madureira (2008a), allowing its application in clinical and research contexts.

VPA describes voice quality through the combination of laryngeal, supralaryngeal, and muscle tension settings, as well as aspects of vocal dynamics, such as pitch, loudness, speech rate, continuous phonation, and respiratory support (Laver; Mackenzie-Beck, 2007). These settings are influenced by intrinsic factors, such as age and anatomical conditions, and by extrinsic factors related to cultural, linguistic, and communicative aspects (Laver, 1980).

Over time, speakers develop relatively stable patterns of muscle configuration, called settings, which characterize their habitual speech style (Laver, 1980; Lima-Silva, 2012). The VPA/VPAS model starts the analysis from the so-called neutral setting, a reference configuration in which the different laryngeal and vocal tract parameters are in an intermediate position, with no predominance of marked tensions, constrictions, or expansions, serving as a comparative point for identifying deviations and variations in vocal production (Laver, 1980; Mackenzie-Beck, 2005; Lima-Silva, 2012). Unlike the notion of "normal" or "altered" voice, frequently used in clinical protocols such as GRBAS, the neutral setting does not imply a judgment of adequacy or the presence of pathology; rather, it is a descriptive reference that allows for the systematic analysis of voice quality variations in various communicative contexts (Lima-Silva, 2012).

VPA-PB is organized into two parts: the first addresses voice quality settings at the supralaryngeal, laryngeal, and muscle tension levels; the second describes aspects of vocal dynamics, including pitch, loudness, continuous phonation, speech rate, and respiratory support (Camargo; Madureira, 2008a). The protocol uses a 6-point scale to classify the intensity of settings and requires specific training to ensure reliable auditory-perceptual evaluation (Camargo; Madureira, 2008b; Lima-Silva, 2012; Dantas, 2022).

Studies have applied VPA to address voice disorders, accent, expressiveness, forensic phonetics, and vocal profiles of communication professionals (Madureira, 1992; Lima-Silva, 2012; Dantas, 2022). Research indicates that the instrument allows the investigation of relationships between sound and meaning in spoken discourse, revealing how different vocal settings contribute to communicative and expressive effects (Madureira, 1992).

In the case of teachers, recognized as a group susceptible to voice disorders, studies indicate that vocal alterations are not limited to the glottal source but also involve articulatory, respiratory, and tension settings (Rufino *et al.,* 2025). Studies using VPA-PB have identified recurrent patterns of laryngeal hyperfunction, pharyngeal constriction, tension settings, and alterations in vocal dynamics among teachers with and without vocal complaints (Lima-Silva, 2012; Azevedo, 2024; Alencar, 2025; Fernandes *et al.,* 2025).

Thus, by enabling a detailed description of voice quality and vocal dynamics, VPA-PB is an important tool for investigating teachers' speech expressiveness and supporting speech-language interventions aimed at vocal health and improved classroom communication.

2. METHODS

2.1. STUDY DESIGN

This study is characterized as an intervention-based research report with a longitudinal, comparative design and a mixed-methods (qualitative–quantitative) approach. It was conducted within the outreach program named Voice Advisory Program for Teachers (ASSEVOX), linked to the Department of Speech-Language Pathology at the Federal University of Paraíba (UFPB), Brazil.

The study was approved on January 7, 2025, by UFPB's Human Research Ethics Committee under approval number 5.960.571 and CAAE 65750222.1.0000.5188, in accordance with Resolution No. 466/12, of December 12, 2012, of the National Commission for Research Ethics.

2.2. STUDY SETTING AND PERIOD

The study was conducted in a state military public school in João Pessoa, Paraíba, Brazil. The school was selected due to the institution's interest in participating in the research. Data were collected between March and December 2025.

2.3. INFORMED CONSENT

All participants were informed about the study procedures and voluntarily signed a written informed consent form prior to participation.

2.4. STUDY PARTICIPANTS

Teachers from the state military school in Paraíba were selected by convenience sampling, based on their interest in participating in the study. All participants signed an informed consent form. Among the recruited teachers, four high school teachers completed all study stages. Their demographic characteristics are presented in Tables 1 and 2.

Variables	n (%)
Sex	
Male	4 (100.00%)
Weekly workload	
Up to 10 hours per week	1 (25.00%)
11 to 20 hours per week	1 (25.00%)
21 to 30 hours per week	2 (50.00%)

Note: n = number of participants. Source: Developed by the authors. João Pessoa, 2026.

Table 1. Sample characterization according to the teachers' sex and weekly workload. João Pessoa, 2026. ALT: Table presenting sample distribution by sex and weekly workload. All participants are male (n=4, 100%). Weekly workload is distributed as follows: up to 10 hours (n=1, 25%), 11 to 20 hours (n=1, 25%), and 21 to 30 hours (n=2, 50%), with a higher concentration in the 21-30-hour range.

Variables	Min	Q_1	Mean	Median	Q_3	Max	SD
Age	33.00	36.50	45.75	45.50	55.00	59.00	11.52
Years of teaching experience	10.00	12.50	18.75	19.00	25.00	27.00	7.67

Note: Min = Minimum; Q1 = First quartile; Q3 = Third quartile; Max = Maximum; SD = Standard deviation.
Source: Developed by the authors. João Pessoa, 2026.

Table 2. Sample characterization according to age and years of teaching experience of the participating teachers. João Pessoa, 2026. ALT: Table presenting descriptive statistics for age and years of teaching experience. Age ranges from 33 to 59 years, with a mean of 45.75 and a median of 45.50 years. Teaching experience ranges from 10 to 27 years, with a mean of 18.75 and a median of 19.00 years, with moderate variability in both variables.

2.5. ELIGIBILITY CRITERIA

The study eligibility criteria were as follows: male teachers of any age group from the State Military Police School in João Pessoa, Paraíba, Brazil, who taught middle or high school, and participated in all study stages, including the speech-language intervention and evaluation procedures before and after the intervention.

2.6. DATA COLLECTION INSTRUMENT

After selecting the teachers who met the study eligibility criteria, the participants underwent the following procedures:

1. **Pre-intervention stage:** administration of a sociodemographic questionnaire to collect identification and professional data and voice recordings for auditory-perceptual evaluation.
2. **Speech-language intervention on speech expressiveness:** consisting of four in-person sessions, lasting 50 to 60 minutes each, including theoretical and practical activities related to speech expressiveness.
3. **Post-intervention stage:** voice re-recording for auditory-perceptual evaluation.

Speech samples intended for auditory-perceptual evaluation were recorded in two speech styles: read speech (RS) and real classroom context (RCC).

RS was recorded in an acoustically treated room in the Paraíba Military Police Education Center, where the school operates. RCC, in turn, was recorded in the classroom where the teacher normally taught to capture real vocal use conditions.

A Zoom H1n digital recorder with an integrated on-board unidirectional cardioid polar microphone was used to record speech tasks (RS and RCC). Recordings were made in PCM (.wav) format, with a 48 kHz sampling rate and 16-bit resolution, ensuring high audio quality and minimizing interference from background noise.

In the RS task, teachers were asked to read three standardized and phonetically balanced sentences from the VPA-PB protocol, as follows: "*O objeto de estudo da fonética é essa complexa, variável e poderosa face sonora da linguagem: a fala*" ("The object of study in phonetics is this complex, variable, and powerful sound aspect of language: speech"); "*Detesto ir à casa dele, pois fica do outro lado da cidade e o acesso é difícil*" ("I hate going to his house because it's on the other side of town and difficult to get to"); and "*Não mencionei anteriormente, mas minha mãe morou muitos anos em Santos, numa mansão à beira-mar*" ("I didn't mention it before, but my mother lived for many years in Santos, in a mansion by the sea"). Each teacher repeated each sentence three times to allow the selection of the most representative sample of each utterance.

The choice of the RCC task in this study aimed to analyze the teacher's voice use in a situation close to everyday classroom practice. This type of task allows a more natural observation of the vocal and expressive settings used during teaching activities, as previously reported in a recent study (Azevedo, 2024).

VPA-PB was used for the auditory-perceptual evaluation of speech samples (RS and RCC), corresponding to the translated and adapted version of the original VPA.

2.7. SPEECH-LANGUAGE INTERVENTION FOR SPEECH EXPRESSIVENESS

The speech-language intervention aimed at improving teachers' speech expressiveness was conducted individually or in pairs at the Military Police School, during the teachers' free periods. The intervention consisted of four sessions lasting 50 to 60 minutes that included theoretical and practical content related to speech expressiveness.

The sessions were structured around the following central themes: breathing, articulation, frequency and intensity modulation, resonance, and vocal warm-up and cool-down techniques. The content addressed in each session is described below.

2.7.1. SESSION 1 – BREATHING

- **Theoretical content:** Basic notions of anatomy and physiology of voice production; fundamental principles of interpersonal communication; use of slides, videos, and audio materials as instructional resources.
- **Practical content:** Body and neck stretching; breathing exercises including diaphragmatic breathing with lip braking; sustained maximum inhalation; wide movements of the costodiaphragmatic region during sequences of deep inhalations and exhalations; fricative sound technique with transition to voicing (sss... → zzz...); and reading sentences aloud with gradually increasing length.

2.7.2. SESSION 2 – ARTICULATION AND FREQUENCY AND INTENSITY MODULATION

- **Theoretical content:** Discussion of home activities; vocal psychodynamics; articulatory patterns of speech; intonational aspects, including loudness, pitch, speech rate, emphasis, and pauses; use of slides, videos, and audio materials.
- **Practical content:** Body and neck stretching; myofunctional exercises such as lip protrusion and smiling; tongue clicks against the palate (with variation in lip extension); overarticulation technique; trill sounds with modulated emissions; semi-occluded vocal tract exercise using a high-resistance straw; vocal fry technique; blowing associated with high-pitched sound; analysis of videos of communication professionals and simulation of expressive settings; and reading poetry aloud with focus on the perception of prosodic resources.

2.7.3. SESSION 3 – RESONANCE, VOCAL WARM-UP, AND VOCAL COOL-DOWN

- **Theoretical content:** Discussion of home activities; importance of resonance, vocal warm-up, and vocal cool-down in teaching; relationship between body posture and voice production; use of slides, videos, and audio materials.
- **Practical content:** Body and neck stretching; fricative sounds with transition to voicing (sss... → zzz...); neck movements and shoulder rotation associated with trill sounds; nasal sounds with cupped hands; yawn–sigh technique; sustained emission of the vowel "ô"; analysis of audio samples with different resonance patterns and comparison between warmed-up and cooled-down voices; and reading the text, *"The Lion and the Mouse"* before and after the exercises.

2.7.4. SESSION 4 – REVIEW OF THE MAIN CONTENTS

- **Theoretical content:** Discussion of home activities; participants' testimonials about their experience in the program; reflections on improvements and aspects to be further developed; feedback from the speech-language pathologist.
- **Practical content:** Body and neck stretching; trill sounds with modulated emissions; resonance technique with chewing; glottal firmness technique; overarticulation technique; analysis of a text without punctuation marks (perceptual marking of pauses and intonation); reading aloud with appropriate use of prosodic resources; and handing out the Speech Expressiveness Booklet**.**

A speech-language pathologist conducted the weekly sessions. At the beginning of the intervention, teachers received water bottles to encourage hydration during their professional activities. At the end of the program, participants received a certificate of participation and a booklet containing the main theoretical and practical content on speech expressiveness, aimed at reinforcing long-term learning.

2.8. PERCEPTUAL EVALUATION PROCEDURES

The speech samples (RS and RCC) were labeled according to the teacher's number, as follows: P1a/P1b and P1c/P1d (teacher 1), P2a/P2b and P2c/P2d (teacher 2), P3a/P3b and P3c/P3d (teacher 3), and P4a/P4b and P4c/P4d (teacher 4). The samples were edited using Audacity software version 3.7.7 and stored on Google Drive in digital audio format.

Then, an online meeting was held via Google Meet with three judges experienced in applying VPA-PB for them to perform the auditory-perceptual evaluation of the samples. The latter were presented in pairs (before and after the intervention), in random order and blindly, without identifying the condition of the recordings to the evaluators.

Representative excerpts of teachers' habitual voice use were selected for real-world classroom samples (RCC), prioritizing segments with satisfactory acoustic quality, low noise interference, and sufficient duration for analysis of the parameters foreseen in the protocol. The use of these samples aimed to complement the RS tasks, observing voice quality in a natural context of professional voice use.

The judges were instructed to use supra-aural headphones and were allowed to repeat each stimulus up to three times, recording their auditory-perceptual impressions directly in the protocol. They analyzed the VPA-PB parameters related to supralaryngeal, laryngeal, muscle tension, and vocal dynamics adjustments, as well as their respective degrees of manifestation.

The final definition of the identified adjustments and their respective degrees occurred by consensus among the three judges during the evaluation session, after joint discussion of each sample, seeking greater uniformity and reliability in the auditory-perceptual evaluation.

3. RESULTS AND DISCUSSION

This study aimed to analyze the effects of a speech-language intervention on speech expressiveness based on perceptual data regarding vocal quality and vocal dynamics in four teachers from a state military school in Paraíba, Brazil. The results indicated changes in vocal quality and dynamic settings after the speech-language intervention on teachers' speech expressiveness in both RS and RCC samples.

A higher prevalence of male teachers is expected in military schools due to the historical and structural origins of these institutions, traditionally linked to the Armed Forces and to hierarchical organization models in which male participation has historically been predominant (Alencar, 2025). Furthermore, sociocultural aspects related to the military career (e.g., association with command roles, discipline, and leadership) still influence the greater participation of men in these spaces (Alencar, 2025).

In addition to the postural and communicative demands inherent to the military, teachers working in this environment may be exposed to vocal health risk factors of individual, environmental, and organizational origin (Masson; Ferreira; Maeno, 2024). The presence of these factors alone or in combination may intensify vocal loading and contribute to the development of voice disorders among teachers (Penha *et al.,* 2021).

Masson, Ferreira, and Maeno (2024) highlight that one of the conceptual advances in occupational voice disorder was overcoming the former tendency to blame teachers for vocal misuse or abuse, recognizing that vocal behaviors are often adaptive responses to the demands imposed by the work environment. Thus, more intense communication or increased vocal intensity in the military should not be interpreted as individual failures, but rather as functional strategies in response to specific institutional demands.

This study found a variability in weekly workload, ranging from 10 to 30 hours per week among participants, with an average of 18 years of teaching experience. The literature indicates that the greater the workload and the longer the professional career, the higher the probability of developing voice disorders, which may negatively affect teachers' professional performance and vocal well-being (Atalik *et al.,* 2025).

Furthermore, the teachers' mean age in this study was 45.75 years. Evidence suggests that older age may be associated with physiological changes in the vocal tract, affecting parameters such as vocal stability, intensity, range, and endurance (Santos *et al.,* 2023). Structural changes in the larynx and modifications in pneumophonoarticulatory coordination may occur with aging, resulting in increased vocal effort and potentially reduced vocal efficiency, with variable impacts on voice quality (Atalik *et al*., 2025).

Regarding the vocal quality and vocal dynamic settings, the VPA-PB identified differences in both RCC and RS between pre- and post-intervention.

Before the intervention, the most prevalent non-neutral settings in the RCC task were vocal tract hyperfunction (n = 3 at degree 4; and n = 1 at degree 2), laryngeal hyperfunction (n = 1 at degree 6; n = 1 at degree 4; and n = 1 at degree 2), and raspy voice (n = 2 at degree 2; n = 1 at degree 4; and n = 1 at degree 5). These patterns were observed in three of the four teachers evaluated, constituting the core vocal pattern identified during this period (Chart 1 and Figure 1). The coexistence of laryngeal and supralaryngeal hyperfunction associated with raspy voice suggests increased muscle tension along the vocal tract and vibratory instability during phonation (Lima-Silva, 2012).

Settings	P1 PRE	P1 POST	P2 PRE	P2 POST	P3 PRE	P3 POST	P4 PRE	P4 POST
Non-neutral vocal quality settings								
Lowered tongue body	3	3				2	3	3
Raised tongue body			4	3				
Retracted tongue body	3	3			2	2	2	3
Laryngeal friction with air escape			3		3		1	
Lowered larynx	3						3	4
Raised larynx			3	2	3	1		
Advanced tongue blade	3							
Rounded lips	3							
Increased jaw extension	4	4			2	4		
Closed jaw							2	1
Pharyngeal expansion	3	5						
Vocal tract tension (hyperfunction)	4		4	4	4	3	2	
Laryngeal tension (hyperfunction)			6	4	4	3	2	
Creaky voice					2			
Raspy voice	2		4		5	2	2	

Note: Numbers represent the degree of occurrence according to VPA-PB. Source: Developed by the authors. João Pessoa, 2026.

Chart 1. Occurrence of non-neutral vocal quality settings and their respective degrees (VPA-PB) in the real classroom context (RCC) before and after the intervention. ALT: Two-way table presenting the occurrence and degree (VPA-PB) of non-neutral vocal quality settings in a real classroom context for four participants (P1–P4), comparing pre- and post-intervention columns. Rows include tongue body position (lowered, raised, retracted), laryngeal adjustments, jaw configuration, lip rounding, pharyngeal expansion, vocal tract and laryngeal tension, and voice quality types (creaky, raspy). Numerical scores (1–6) indicate the degree of occurrence, showing variability across participants and changes between moments, including reductions, persistence, and increases in specific settings after intervention. The blank spots correspond to neutral settings.

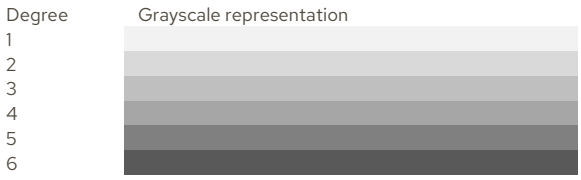

Figure 1. Grayscale representation according to the degree of settings in VPA-PB. ALT: Grayscale representing six graded levels (1 to 6), arranged vertically from the lightest (level 1) to the darkest (level 6), indicating a progressive increase in the degree of vocal settings in VPA-PB.

These findings are consistent with the profile of teachers observed by Fernandes *et al.* (2025), who identified raspy voice as the most frequently perceived phonatory setting (80%), often co-occurring with laryngeal hyperfunction. Similarly, Lima-Silva (2012) and Azevedo (2024) highlighted that the combination of laryngeal hyperfunction, raspy voice, and raised larynx is recurrent among teachers, suggesting a pattern of excessive muscle effort and vocal fatigue resulting from high occupational demand and environmental noise.

Alencar (2025) aimed to analyze vocal quality and vocal dynamics from a phonetic-perceptual perspective in basic education teachers working in a military school. The results showed that the

most frequent settings were laryngeal hyperfunction and vocal tract hyperfunction associated with a raspy voice. These findings indicate overload of the phonatory system and possibly voice disorders in this population.

This vocal loading pattern is often found in voice professionals, including teachers and other professional categories with high communicative demands, such as emergency call operators (Dantas, 2022; Lima *et al.,* 2022). In these contexts, prolonged and intensive voice use, often combined with adverse environmental and organizational conditions, may contribute to the development of phonatory settings characterized by increased muscle tension and greater vocal effort during speech production.

From a phonetic-perceptual perspective, such configurations may be interpreted as a profile potentially associated with vocal effort and reduced phonatory economy. However, these settings should not be interpreted alone or solely from a pathological perspective, since in certain communicative situations, some settings may represent adaptive strategies to meet the demands of the vocal use context.

The frequency of some non-neutral settings decreased after the speech-language intervention, such as laryngeal hyperfunction (n = 1 at degree 4; n = 1 at degree 3), vocal tract hyperfunction (n = 1 at degree 4; n = 1 at degree 3), raspy voice (n = 1 at degree 2), and the absence of air escape. These findings suggest a possible reorganization of the teachers' phonatory behavior, with a reduction in patterns associated with increased muscle tension and unstable vocal fold vibration. This reduction may indicate greater efficiency in vocal production and improved functional balance of the vocal tract.

According to the literature (Penha *et al.,* 2021; Rufino *et al.,* 2025; Pereira *et al*., 2025), speech-language intervention can promote teachers' vocal health significantly by encouraging the development of strategies for more efficient voice use, thus improving vocal quality.

In this regard, Penha *et al.* (2021) sought to verify the effectiveness of a vocal advisory program aimed at elementary school teachers in different teaching modalities. The study included 59 teachers, of whom 33 belonged to the control group (in-person modality) and 26 to the experimental group (hybrid modality). Four theoretical-practical workshops were conducted, addressing several topics such as anatomy and physiology of voice production; causes and symptoms of voice disorders; vocal care; vocal projection, articulation, and resonance; body posture in the classroom; differences between normal, altered, and adapted voice; strategies to deal with classroom noise; laryngeal diseases; work environment and organization; vocal psychodynamics; and verbal and non-verbal expressiveness. They also performed breathing, myofunctional, and vocal warm-up and cool-down exercises. The results showed that both groups improved their vocal quality after the intervention, particularly regarding roughness and breathiness, demonstrating the effectiveness of vocal advisory for teachers.

It is noteworthy that no changes were observed in the retracted tongue body setting before and after the intervention in either the RS or RCC tasks, remaining present in both time points. In VPA-

PB, this setting is associated with a reduction in the anterior oropharyngeal space, which may contribute to a more posterior resonance pattern. However, for the population investigated, this finding may also be related to articulatory characteristics typical of male speakers, as described by Lima *et al.* (2007), who point to an association with the lowering of the fundamental frequency (f0) and the consequent production of a lower pitch.

Furthermore, it is important to consider that the settings of the retracted and lowered tongue body may reflect phonetic traits associated with the local accent. As described by Lima *et al.* (2007) and Dantas (2022), this articulatory pattern may represent dialectal characteristics of the regional speech of João Pessoa and should not necessarily be interpreted as indicative of vocal alteration.

Another vocal setting recurrently observed in both speech tasks (RCC and RS) was the lowered larynx in the speech samples. The vertical configuration of the larynx maintains a direct proportional relationship with the parameters of fundamental frequency, since a lower position in the neck favors a lengthened vocal tract, resulting in a lower pitch (Neuhaus; Scherer; Whitfield, 2024). In the case of this group, such a setting may be explained by the biological characteristics of the sample, composed exclusively of male teachers (Dantas, 2022).

In the RS task, the most predominant vocal quality settings before the intervention were laryngeal hyperfunction (n = 1 at degree 1; n = 1 at degree 3; and n = 1 at degree 4), closed jaw (n = 3 at degree 3; and n = 1 at degree 4), raspy voice (n = 2 at degree 4; and n = 1 at degree 1), and air escape (n = 2 at degree 3; and n = 1 at degree 1), findings similar to those observed in the RCC task (Chart 2). These results suggest the presence of a vocal production pattern characterized by greater phonatory effort and muscle settings that reflect tension in the laryngeal region and vocal tract (Dantas, 2022).

Settings	P1 PRE	P1 POST	P2 PRE	P2 POST	P3 PRE	P3 POST	P4 PRE	P4 POST
Non-neutral vocal quality settings								
Lowered tongue body	3	3	3	3	1		1	1
Retracted tongue body	3	3				2	1	1
Laryngeal friction with air escape			3	2	3	1	1	
Lowered larynx	4	4	1	1	1	1	2	1
Advanced tongue blade			3	2				
Open jaw		2						
Increased jaw extension						3		
Decreased jaw extension			3	3	1			
Closed jaw	1						1	
Pharyngeal expansion	4	4						
Nasality			3	2				
Vocal tract tension (hyperfunction)						1	1	
Laryngeal tension (hyperfunction)			4		3		1	
Creaky voice	4	5	4	2		1		
Raspy voice					4	2	1	
Breathy voice			4					

Note: Numbers represent the degree of occurrence according to VPA-PB. Source: Developed by the authors. João Pessoa, 2026.

Chart 2. Occurrence of non-neutral vocal quality settings and their respective degrees (VPA-PB) in the Read Speech (RS) task before and after the intervention. ALT: Two-way table reporting the occurrence and degree (VPA-PB) of non-neutral vocal quality settings in a read speech task for four participants (P1–P4), with columns for pre- and post-intervention. Rows list settings such as tongue body position, laryngeal adjustments, jaw configuration, nasality, vocal tract and laryngeal tension, and voice quality types

(creaky, raspy, breathy). Numerical scores (1–5) indicate the degree of occurrence, showing variability across participants and time points, with some settings reduced, absent, or emerging after intervention. The blank spots correspond to neutral settings.

Laryngeal hyperfunction was absent, and rough voice (n = 1 with degree 2) and air escape (n = 1 with degree 1; and n = 1 with degree 2) had decreased after the intervention. In addition, two teachers improved their jaw-opening pattern. These changes suggest positive effects of speech-language intervention, possibly related to greater flexibility in vocal and articulatory settings, favoring freer and potentially more expressive speech production.

The literature reports that increased jaw opening contributes to greater articulatory mobility and improved vocal resonance, favoring voice projection and speech clarity (Castillo-Allendes *et al.,* 2024). Furthermore, greater freedom of jaw movement tends to reduce tension patterns in the vocal tract, which may contribute to a more efficient and less hyperfunctional vocal production (Lima-Silva, 2012).

Regarding vocal dynamic settings in RCC after the intervention, there was greater occurrence of increased habitual loudness (n = 2 with degree 1; and n = 2 with degree 4), loudness with increased variability **(**n = 2 with degree 4; n = 1 with degree 5; and n = 1 with degree 1), pitch with increased variability (n = 2 with degree 3; and n = 1 with degree 4), and adequate respiratory support (n = 2 with degree 2; and n = 1 with degree 4), in addition to the absence of interrupted continuity (Table 3).

Settings	P1 PRE	P1 POST	P2 PRE	P2 POST	P3 PRE	P3 POST	P4 PRE	P4 POST
Non-neutral vocal dynamic settings								
Interrupted continuity	4		3		2			
Increased habitual loudness	4	1	5	4		4		1
Decreased habitual loudness							4	
Greater loudness variability		4		4	5	5	2	1
Lower loudness variability			6					
Increased pitch variability		3			2	4	1	3
Inadequate respiratory support	4		3	1	3		1	
Adequate respiratory support		2				4		2

Note: Numbers represent the degree of occurrence according to VPA-PB. Source: Developed by the authors. João Pessoa, 2026.

Table 3. Occurrence of non-neutral vocal dynamic settings and their respective degrees (VPA-PB) in the real classroom context (RCC) before and after the intervention. ALT: Two-way table showing the occurrence and degree (VPA-PB) of non-neutral vocal dynamic settings in a real classroom context for four participants (P1–P4), comparing pre- and post-intervention columns. Rows include continuity, increased and decreased habitual loudness, loudness and pitch variability, and adequate and inadequate respiratory support. Numerical scores (1-6) indicate the degree of occurrence, with changes across participants between time points, including reductions, absences, and increases in specific dynamic settings after intervention. The blank spots correspond to neutral settings.

The increase in pitch and loudness variability in teachers' communication may be considered a positive aspect, as these settings contribute to a more expressive and dynamic speech during the class (Ferreira; Arruda; Marquezin, 2012; Penha *et al.,* 2021; Pecorari; Kyrillos, 2021).

Greater variation in vocal frequency and intensity tends to favor the maintenance of students' attention, in addition to making the message clearer and emphasizing relevant information throughout the exposition (Pecorari; Kyrillos, 2021). In the educational context, such resources are also associated with more effective communication, as they help to organize the discourse and mark different moments of speech, such as explanations, examples, and emphasis on key content

(Cordeiro; Tozzo; Ferreira, 2021). Thus, the increase in the variability of these parameters after the intervention may indicate a more functional and strategic use of the voice in teaching.

The reduction of inadequate respiratory support and the absence of interrupted continuity after the intervention may be due to improved breathing-speech coordination promoted during the intervention, which addressed vocal and respiratory techniques that assist in better management of airflow during speech production.

Strategies such as reading texts and poems aloud and simulating classrooms during the intervention may have helped to organize discourse more appropriately and maintain speech fluency, promoting greater respiratory control and better coordination between breathing, phonation, and articulation.

The settings with the highest occurrence in the RS task after the intervention were increased pitch variability (n = 2 with degree 2; and n = 1 with degree 4) and improved respiratory support, with adequate settings in one participant and a reduction in the degree of inadequacy in others (Table 4).

Settings	P1 PRE	P1 POST	P2 PRE	P2 POST	P3 PRE	P3 POST	P4 PRE	P4 POST
Non-neutral vocal dynamic settings								
Decreased habitual loudness			4	1	2	1	4	
Increased loudness variability								1
Decreased loudness range			4		2			
Decreased loudness variability			4					
Lowered habitual pitch	4	5	2	1	2	1		
Decreased pitch range			4					
Decreased pitch variability	3	2	4					
Increased pitch variability				2		1		1
Faster speech rate	3	2			3			
Inadequate respiratory support	2		3	1				1
Adequate respiratory support							1	

Note: Numbers represent the degree of occurrence according to VPA-PB. Source: Developed by the authors. João Pessoa, 2026.

Table 4. Occurrence of non-neutral vocal dynamic settings and their respective degrees (VPA-PB) in the read speech (RS) task before and after the intervention. **ALT:** Two-way table presenting the occurrence and degree (VPA-PB) of non-neutral vocal dynamic settings in a read speech task for four participants (P1–P4), with pre- and post-intervention columns. Rows include decreased habitual loudness, loudness variability and range, pitch (level, range, and variability), speech rate, and adequate and inadequate respiratory support. Numerical scores (1–5) indicate the degree of occurrence, showing changes across participants between moments, including reductions, persistence, and emergence of specific dynamic patterns after the intervention. The blank spots correspond to neutral settings.

Prolonged voice use in teaching requires vocal endurance and adequate coordination between breathing and phonation (Lima-Silva *et al.,* 2024). Therefore, speech-language interventions that include respiratory training and the conscious use of the voice may contribute to more stable, efficient, and comfortable communication during classroom activities.

Similar results were observed in the study by Cordeiro, Tozzo, and Ferreira (2021), which investigated the effects of a speech-language intervention focused on speech expressiveness in

three preschool teachers, with emphasis on reading stories aloud. The intervention consisted of six sessions at school, addressing different parameters of vocal expressiveness, such as breathing, pauses, articulation, resonance, pitch, and loudness, in addition to aspects related to vocal well-being and non-verbal expressiveness. The results showed an increase in the duration of utterances in all participating teachers, as well as improved respiratory support, more appropriate pause placement, and a more melodic and engaging speech pattern.

Overall, the speech-language intervention focused on teachers' speech expressiveness proved capable of promoting positive changes, such as reduced overload in the phonatory system and improved use of prosodic resources during communication. The absence of some settings (e.g., air escape, breathy voice, and laryngeal hyperfunction) frequently associated with phonatory overload was also observed after the intervention. These findings suggest that the intervention contributed to a more balanced and efficient vocal use during speech production.

In the classroom context, the changes resulting from the intervention were more evident, as the classroom is a more natural and dynamic communicative context, in which the teacher mobilizes expressive speech resources (e.g., variations in intonation, intensity, and rhythm) more spontaneously to maintain students' attention and facilitate content comprehension (Azevedo, 2024). In contrast, the RS task is a more structured and controlled activity, with less freedom for prosodic variation and full use of vocal and articulatory settings, which may reduce the manifestation of changes promoted by the intervention. Thus, the classroom context tends to reveal more clearly the effects of speech-language intervention on speech expressiveness.

Speech-language interventions for teachers' speech expressiveness, as observed in this study, benefit their vocal health and improve prosodic resources in their communication. These findings reinforce the importance of conducting future studies to investigate the inclusion of speech expressiveness training and the use of VPA-PB to identify changes in vocal quality and vocal dynamics.

It is important to highlight that the proposal developed in this study aimed to promote health education rather than to provide speech-language therapy. Furthermore, as this study had few participants, the results should be interpreted with caution and cannot be generalized to the broader teaching population.

Therefore, further research is warranted with larger samples (more teachers and different education levels) to deepen the understanding of the effects of interventions focused on speech expressiveness and vocal health in education.

4. FINAL CONSIDERATIONS

The results of this study showed a reduction in laryngeal hyperfunction, vocal tract hyperfunction, and raspy voice, increased pitch and loudness variability, and improved respiratory support,

suggesting enhancements in vocal quality and enhanced speech expressiveness. These findings indicate that the proposed intervention effectively promoted more balanced vocal settings, favoring greater prosodic flexibility, communicative efficiency, and reduced phonatory effort.

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ADDITIONAL INFORMATION

CONFLICT OF INTEREST

The authors declare that they have no conflicting interests.

STATEMENT OF DATA AVAILABILITY

The derived data, perceptual analysis materials, coding instruments, and ChatGPT prompts used during manuscript preparation that support the findings of this study are openly available in the Zenodo repository via DOI: https://doi.org/10.5281/zenodo.19412263. Raw voice recordings cannot be shared publicly due to participant confidentiality requirements established by the ethics committee approval (CAAE 65750222.1.0000.5188). Access to restricted data may be requested by contacting Maria Fabiana Bonfim de Lima-Silva (UFPB) at fbl_fono@yahoo.com.br, subject to the approval of the requesting researcher's institutional ethics committee and the signing of a data access agreement. Requests are typically reviewed within 15–30 days.

AI USE STATEMENT

During the preparation of this manuscript, the authors used ChatGPT (OpenAI, GPT-4o) to assist with information retrieval, grammar checking, sentence rephrasing for clarity, and revision of alternative text (ALT text), with minimal contribution to the final content. All outputs generated by

ChatGPT were carefully reviewed and edited by the authors, who take full responsibility for the content of the manuscript. The prompts used with ChatGPT are openly available in the Zenodo repository (Penha *et al.,* 2026), at: https://doi.org/10.5281/zenodo.19412263.

ETHICS AND CONSENT

The study was approved on January 7, 2025, by the Human Research Ethics Committee of the Federal University of Paraíba under approval number 5.960.571 and CAAE 65750222.1.0000.5188. All participants were informed about the study procedures and voluntarily signed a written informed consent form prior to participation.

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