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Effects of a technology-mediated educational intervention on the vocal health of elementary school teachers in Cuiabá-MT: a quasi-experimental study

Efeitos de uma intervenção educativa mediada por tecnologias na saúde vocal de professores do ensino fundamental de Cuiabá-MT: estudo quase experimental

Efectos de una intervención educativa mediada por tecnologías en la salud vocal de profesores de escuela primaria en Cuiabá-MT: estudio casi experimental

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Abstract

Introduction: teachers are exposed to several risk factors for voice, causing work-related voice disorders. Information and communication technologies can promote teachers' vocal health. **Objective:** to analyze the effects of an educational intervention mediated by technologies on the vocal health of elementary school teachers. **Method:** this is a quasi-experimental study, conducted with elementary school teachers from four public schools. In-person vocal screenings were applied before and after the intervention and eight synchronous meetings were held over a period of one month with vocal guidance

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ACMS: researcher; research development; literature review; data collection and analysis; and writing of the article.
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and exercises. Statistical tests were applied to compare the pre- and post-intervention moments. **Results:** the intervention provided a significant reduction in vocal symptoms, such as hoarseness and loss of voice, and in the Screening Index for Voice Disorders. Teachers reported taking more vocal care after the intervention, such as vocal rest, warming up and cooling down their voice. There was an improvement in self-assessment of satisfaction with their voice after the intervention. However, the intervention was not enough to promote changes in some vocal habits. **Conclusion:** the intervention was essential to reduce vocal symptoms and self-reported voice disorders among teachers, providing new vocal care and increasing satisfaction with one's own voice. The adoption of continuing voice training is essential to modify habits and behaviors in this population.

Keywords: School Teachers; Voice; Distance Learning through ICT; Voice Training; Teacher Training.

Resumo

Introdução: os professores estão expostos a diversos fatores de risco para a voz, ocasionando o distúrbio de voz relacionado ao trabalho. As tecnologias da informação e comunicação podem favorecer saúde vocal de professores. **Objetivo:** analisar os efeitos de uma intervenção educativa mediada por tecnologias na saúde vocal de professores do ensino fundamental. **Método:** trata-se de um estudo quase-experimental, realizado com professores do ensino fundamental de quatro escolas públicas, foram aplicadas triagens vocais presenciais pré e pós-intervenção e oito encontros síncronos realizados no período de um mês com orientações e exercícios vocais. Testes estatísticos foram aplicados para comparar os momentos pré e pós-intervenção. **Resultados:** a intervenção proporcionou a redução significativa de sintomas vocais, como a rouquidão e a perda da voz, e do Índice de Triagem para o Distúrbio de Voz. Os professores referiram realizar mais cuidados vocais após a intervenção, como fazer repouso vocal, aquecer e desaquecer a voz. Houve melhora da autoavaliação de satisfação com a voz após a intervenção. Contudo, a intervenção não foi suficiente para promover a mudança de alguns hábitos vocais. **Conclusão:** a intervenção foi essencial para reduzir sintomas vocais e o distúrbio de voz autorreferido entre professores, proporcionando novos cuidados vocais e aumento da satisfação com a própria voz. A adoção da formação continuada em voz é primordial para a modificação de hábitos e comportamentos nesta população.

Palavras-chave: Professores Escolares; Voz; Formação à Distância através das TIC; Treinamento da Voz; Capacitação de Professores.

Resumen

Introducción: los docentes están expuestos a diversos factores de riesgo para su voz, causantes de trastornos vocales relacionados con el trabajo. Las tecnologías de la información y la comunicación pueden promover la salud vocal de los docentes. **Objetivo:** analizar los efectos de una intervención educativa mediada por tecnologías sobre la salud vocal de docentes de educación primaria. **Método:** se trata de un estudio cuasi experimental, realizado con docentes de educación básica de cuatro escuelas públicas, se aplicaron tamizajes vocales presenciales antes y después de la intervención y se realizaron ocho encuentros sincrónicos en un periodo de un mes con orientación y ejercicios vocales. Se aplicaron pruebas estadísticas para comparar los momentos pre y post intervención. **Resultados:** la intervención proporcionó una reducción significativa de los síntomas vocales, como ronquera y pérdida de voz, y del índice de detección de trastornos de la voz. Los maestros informaron que después de la intervención tomaron más cuidado vocal, como tomar descanso vocal, calentar y enfriar la voz. Se observó una mejora en la autoevaluación de la satisfacción con la voz después de la intervención. Sin embargo, la intervención no fue suficiente para promover cambios en algunos hábitos vocales. **Conclusión:** la intervención fue esencial para reducir los síntomas vocales y los trastornos de voz autoreportados entre los docentes, proporcionando nuevos cuidados vocales y una mayor satisfacción con la propia voz. La adopción de un entrenamiento vocal continuo es fundamental para cambiar hábitos y comportamientos en esta población.

Palabras clave: Maestros; Voz; Formación a distancia a través de las TIC; Entrenamiento de la Voz; Formación del Profesorado.

Introduction

The use of information and communication technologies (ICTs) is increasingly present in people's lives, with increased access to technological and connectivity devices[1]. The Continuous National Household Sample Survey (PNAD Continue) conducted in the fourth quarter of 2022 showed that 91.5% of the Brazilian population had access to the internet at home and 86.5% of individuals aged 10 or over had a mobile phone for personal use[2].

With the advent of Covid-19, there was an increase in telehealth, which is considered the provision of remote health services[1]. The use of ICTs in health services provided numerous benefits, with reduced travel costs, access to specialized professionals from large health centers, increased communication speed, convenience, among others. In this sense, telehealth has broad areas of activity, such as teleconsulting, telediagnosis, second formative opinion and teleeducation[3].

This study proposes using tele education as a tool to promote teachers' vocal health and continuing education. Tele education consists of the use of ICTs to hold conferences, classes, training sessions and courses synchronously in real time or asynchronously with offline interactions[3]. Tele education aimed at teachers meets the requirements of the Law of Guidelines and Bases of Education (LDB)[4], which provides for initial and continuing education and training of teachers to be carried out by the Union, the Federal District, States and Municipalities, and can be developed with distance education resources and technologies.

Studies mention the benefits of using ICTs in teachers' vocal health[5,6]. An example of this is the research that was developed in São Paulo with 162 municipal school teachers, who participated in a course on the Moodle platform with eight modules (40 hours) and obtained, after the intervention, a significant increase in knowledge about care to maintain a healthy voice, use of verbal and non-verbal expressive resources, and use of strategies to improve the work environment[6].

Among the voice intervention approaches for teachers, there is the indirect approach, which is carried out through guidance and vocal awareness, the direct approach, which consists of carrying out workshops and vocal exercises, and the mixed approach, which is the combination of the first two approaches[7]. The literature indicates that the mixed approach has been more effective among teachers, since voice disorders in this professional category have multiple causes, with individual, behavioral, organizational and working conditions issues, requiring modification of vocal habits, lifestyle, working conditions and improvement of the physiological conditions of the teacher's voice[7,8].

A study published in 2019 with the participation of 6,510 elementary school teachers in Brazil showed that 17.7% had voice disorders and that 78% were absent from work due to voice disorders for a period of 1 to 7 days in the 12-month period preceding the survey[9]. Regarding vocal symptoms, a case-control study, matched by school, with 272 teachers from the municipal education system of São Paulo (167 cases with vocal complaints and 105 controls without vocal complaints), showed that in the case group there was a greater presence of hoarseness, episodes of loss of voice, tiredness when speaking, effort when speaking, dry throat and throat clearing[10].

Vocal disorders in teachers are insidious, worsening after continuous voice use, at the end of the day, and recovering after rest on the weekends. In this way, the voice gradually worsens, and may be completely lost or suffer permanent damage to the vocal folds, affecting the teacher, students, society and the State, and is considered a relevant public health problem[11]. In this case, it is important to implement and execute vocal health conservation programs aimed at teachers.

A scoping review carried out with the objective of mapping and characterizing research in the area of teachers' voice, published in national Speech Therapy journals, from 2011 to March 2021, highlighted the low occurrence of intervention studies when compared to observational studies, as they are more time-consuming and more expensive[12]. In addition, of the 78 studies, less than 10% were carried out in the Central West and North regions of Brazil, with the Southeast region being the most covered, with 53.8% of the studies.

Considering that teachers are voice professionals who can develop Work-Related Voice Disorder and that technologies can be important allies in the training of these professionals, shortening distances and providing access to information to teachers from different schools at the same time. This study aims to analyze the effects of an educational

intervention mediated by technologies on the vocal health of elementary school teachers in the city of Cuiabá, Mato Grosso.

Methods

This is a quasi-experimental study with a time-series design. The research was conducted with elementary school teachers from four public schools in the municipal education system of the city of Cuiabá, state of Mato Grosso, remotely, online, with synchronous meetings, in the second half of 2023.

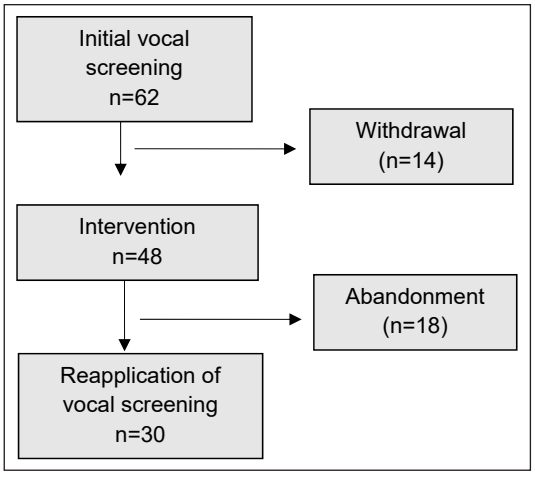
Eligibility criteria

The study included elementary school teachers, graduates in Pedagogy or with a degree, from the municipal public education system of the city of Cuiabá-MT, with at least six months of teaching experience, regardless of gender or sexual orientation, with access to the internet, a smartphone or a personal computer. Teachers on a different function, on leave or away from the classroom, who reported having disabling hearing loss, neurological and/or psychiatric problems and who did not respond to vocal screenings were excluded.

Sample

The sample was calculated using Stata software version 16.0, considering a sample of paired data and the parameters of standard deviation of the difference between pairs of 1.48 and mean standard deviation of 3,12, according to research by Souza et al. (2017)[13], who carried out an intervention with teachers from the public school system for 4 weeks and presented the results of the Screening Index for Voice Disorders (SIVD) pre- and post-intervention. A sample of 37 teachers was obtained and a 20% loss margin was added, resulting in a final sample of 46 teachers.

Four public schools from the municipal elementary school system were randomly selected according to each administrative region of the city of Cuiabá-MT. The schools had 62 eligible teachers, of which 14 withdrew from participating in the meetings. Thus, 48 teachers continued their training in vocal health, but there were even more losses throughout the intervention, 18 teachers did not complete the research and 30 teachers completed the training with at least 75% attendance (Figure 1).



Source: study authors, 2023.

Figure 1. Research participation flowchart

Teachers who did not continue the training received guidance on voice care individually at the school itself. For each dropout and/or abandonment, the teachers were asked the reason, justifying this by having other activities at the same time as the intervention (exercise, going to church, participating in events and others) or by difficulty maintaining an internet connection during the intervention.

Recruitment

Recruitment was carried out in person at the selected schools. The researchers met with all teachers in the schools to inform them of the study objectives and procedures. They then completed the Informed Consent Form, the self-reported eligibility questionnaire, and the initial vocal screening.

Vocal screening

Vocal screening was performed in person at two times, pre- and post-intervention, during the break, before or after class. Teachers self-reportedly answered the Teacher Vocal Production Condition Questionnaire (CPV-P) and the Screening Index for Voice Disorders (SIVD). The questionnaires were made available via QR Code by reading the code on the teacher's own smartphone, which redirected to a Google Forms® link.

The CPV-P, developed by Ferreira et al. (2003)[14], has 62 questions related to sociodemographic data, lifestyle, vocal self-assessment, work

conditions and organization. Responses are completed on a four-point Likert scale (never, rarely, sometimes, always).

The SIVD, developed and validated by Ghirardi et al. (2013)[15], has 12 questions related to vocal symptoms, namely: hoarseness, loss of voice, voice breaks, deep voice, throat clearing, dry cough, cough with secretion, pain when speaking, pain when swallowing, secretion in the throat, dry throat and tiredness when speaking. The participant indicated each symptom on a four-point Likert scale (never, rarely, sometimes, always). The simple sum of the scores of all symptoms was performed, ranging from 0 to 12 points, with the answers "never" and "rarely" receiving no points and "sometimes" and "always" receiving one point. The cut-off score recommended by the authors of the instrument was used, which considers five or more points, which indicates a failure in the screening, and, therefore, a greater probability that the teacher has a probable voice disorder, and should be referred for clinical diagnosis.

In addition, teachers were asked about their satisfaction with their own voice on a five-point Likert scale (very satisfied, satisfied, neither dissatisfied – not satisfied, dissatisfied, and very dissatisfied).

Intervention

The intervention was conducted synchronously, with each meeting lasting one hour, and the teacher was responsible for accessing the sessions using a personal device, such as a smartphone, tablet or computer. The meetings were held twice a week, on Tuesdays and Thursdays, from 6:00 p.m. to 7:00 p.m. or from 7:15 p.m. to 8:15 p.m., over a period of one month, totaling eight meetings. The teachers were able to choose the best time to participate in the intervention, and were divided into two groups to facilitate monitoring of the participants.

The meetings were conducted by a speech therapist with over ten years of experience and specialization in the area of voice, through an adapted training program with a mixed approach, in accordance with other interventions carried out with teachers[5,6,16], strategies outlined in the literature related to vocal improvement for voice professionals[17-20], strategies used in speech therapy clinics for the treatment of behavioral dysphonia[21] and recommendations from the Brazilian Society of Speech Therapy[22]. In the mixed approach, vocal guidelines and exercises are used to promote vocal health[8].

Each meeting followed the following sequence: reception, review, development and accommodation. During the reception, teachers were welcomed and their practical application in daily teaching was verified; during the review, the content learned in the previous meeting was reviewed and any doubts were clarified; during the development, specific topics of the meeting itself were addressed; and during the accommodation, the main points covered were revisited. The objectives worked on in each meeting are presented below:

- **1st meeting** – Objective: to expand knowledge about vocal anatomy and physiology, healthy and harmful habits for the voice. Strategies: discussion group, videos and interactive quiz.
- **2nd meeting** – Objective: to promote vocal projection and resonance. Strategies: conceptualization, nasal sounds technique, tongue clicking technique associated with nasal sounds, chewing technique, yawn-sigh technique, over articulation technique and reading sentences projecting the voice.
- **3rd meeting** – Objective: to improve articulation and diction. Strategies: conceptualization, training of the mobility of the phono articulatory organs, oral diadochokinesis, over articulated speech for months of the year and days of the week, and reading tongue twisters.
- **4th meeting** – Objective: to improve breathing and voice. Strategies: conceptualization, training of inhalation and exhalation, technique of voiceless fricative sounds, training of pneumophono-articulatory coordination and respiratory pauses.
- **5th meeting** – Objective: to encourage the use of emphasis and vocal modulation. Strategies: conceptualization, technique of modulating speech frequency and intensity, musical scale technique, pronouncing phrases modifying the way of speaking considering feelings and punctuation marks, and emitting phrases emphasizing demarcated target words.
- **6th meeting** – Objective: to provide increased vocal resistance. Strategies: conceptualization, glottal firmness technique, vibrant sounds technique, voiced fricative sounds technique, musical scale technique and voiced blowing into a tube technique.
- **7th meeting** – Objective: to encourage the practice of vocal warm-up and cool-down. Strategies:

conceptualization, to warm up the voice: vibrant sounds technique, fricative sounds technique, nasal sounds technique, vocal frequency and intensity modulation technique. To cool down the voice: yawn-sigh technique, production of descending sounds from high to low and prolonged "b" technique.

- **8th meeting** – Objective: to integrate body and voice. Strategies: conceptualization of communication, verbal and non-verbal communication, and exercises: body and neck stretching, body movement technique with facilitating sounds, changing head position with sound, shoulder rotation technique with fricative sounds and practical exercise training in the use of verbal and non-verbal communication.

During the intervention, cards were also prepared together with the participants based on their professional experience and classroom situations, in order to reflect on teaching practice, with the themes "strategies to get the student's attention without having to use the voice", "strategies to get the student's attention using the voice", "strategies to determine the turn to speak" and "strategy to improve behavior in the classroom".

Finally, the intervention was considered complete for teachers who obtained 75% or more attendance and who responded to the post-intervention vocal screening, within a maximum period of one week after the end of the last meeting.

Statistical analysis

After data collection, a Google Forms® data tabulation spreadsheet was generated. Next, statistical analysis was performed using Stata software version 16.1, to obtain the frequency of sociodemographic data, vocal habits, vocal care, vocal symptoms and satisfaction with the voice.

In the pre and post intervention comparison analysis for the qualitative variables related to vocal habits, vocal care, vocal symptoms and voice satisfaction, the McNemar test was performed and for the quantitative variable obtained through the SIVD, the Wilcoxon test was used. In both tests, a p-value ≤ 0.05 was considered statistically significant.

Ethical considerations

This study was submitted for review and authorized by the Research Ethics Committee of the Federal University of the State of Mato Grosso (UFMT), through substantiated opinion no. 6,074,410, CAAE 68138423.3.0000.8124. The participants signed the Free and Informed Consent Form (TCLE).

Results

In Table 1, it is possible to observe that the majority of teachers were female (86.67%), aged 50 to 63 years (53.35%), of mixed race/skin color (56.67%), had a partner (53.33%), worked in a school (56.67%), had teaching experience of over 15 years (63.37%) and spent 40 hours or more per week with students (76.67%).

Table 1. Sociodemographic data of teachers in the municipal public elementary school system in the city of Cuiabá-MT, 2023

Variables	Teachers n (%)
Sex	
Female	26 (86.67)
Male	4 (13.33)
Age group	
25 to 39 years	5 (16.66)
40 to 49 years	9 (29.99)
50 to 63 years	16 (53.35)
Color/race	
White	4 (13.33)
Indigenous	1 (3.33)
Mixed-race	17 (56.67)
Black	8 (26.67)
Marital status	
With partner	16 (53.33)
Without partner	14 (46.66)
Number of schools worked at	
One	17 (56.67)
Two	13 (43.33)
Teaching time	
1 to 15 years	11 (36.63)
Over 15 years	19 (63.37)
Hours per week with students	
Below 40 hours	7 (23.33)
40 hours or more	23 (76.67)

Table 2 shows the pre- and post-intervention comparison for vocal habits and care. The most frequently reported vocal habits were: talking a lot, telling stories, singing in class, speaking in an open space, and shouting. However, the intervention was not enough to change any of the vocal habits, and no significant differences were found when comparing the pre- and post-intervention moments.

Regarding vocal care, the majority reported that they practiced hydration care, and after the intervention there was a significant increase in the number of teachers who began to rest their voices (pre=36.67%; post=76.67%, p-value: 0.002), warm up their voices (pre=3.33%; post=63.33%, p-value: <0.001), and cool down their voices (pre=0%; post=40%, p-value: <0.001).

Table 2. Comparison of vocal habits and care before and after educational intervention mediated by technologies in the vocal health of teachers in the municipal public elementary school network in the city of Cuiabá-MT, 2023

Variables	Pre-intervention n (%)	Post-intervention n (%)	p-value
Vocal habits			
Talking a lot	30 (100.00%)	26 (86.67%)	0.125
Telling stories	28 (93.33%)	29 (96.67%)	1.000
Singing in class	26 (86.67%)	27 (90.00%)	1.000
Speaking in an open space	21 (70.00%)	22 (73.33%)	1.000
Shouting	17 (56.67%)	14 (46.67%)	0.549
Speaking while doing physical activity	16 (53.33%)	10 (33.33%)	0.146
Singing outside of school	16 (53.33%)	15 (50.00%)	1.000
Speaking while carrying weight	10 (33.33%)	7 (23.33%)	0.508
Vocal care			
Keeping hydrated	29 (96.67%)	30 (100.00%)	1.000
Using lozenges and sprays	13 (43.33%)	6 (20.00%)	0.065
Taking vocal rest	11 (36.67%)	23 (76.67%)	**0.002**
Using tea or other natural remedies	9 (30.00%)	6 (20.00%)	0.453
Self-medicating	5 (16.67%)	6 (20.00%)	1.000
Warming up your voice	1 (3.33%)	19 (63.33%)	**<0.001**
Cooling down your voice	0 (00.00%)	12 (40.00%)	**<0.001**

Legend: McNemar test considering statistical significance for p-value ≤ 0.05.

Table 3 presents the vocal symptoms and satisfaction with the voice before and after the intervention. The most frequently reported vocal symptoms were: dry throat, hoarseness, tiredness when speaking and voice failures. After the intervention, there was a significant reduction in hoarseness (pre=73.33%; post=46.67%, p-value: 0.039) and loss of voice (pre=33.33%; post=6.67%, p-value: 0.021).

Regarding satisfaction with the voice, before the intervention, the majority were neither dissatisfied nor satisfied, dissatisfied or very dissatisfied with their voice (60%) and after the intervention, the majority became very satisfied or satisfied with their voice (73.33%), which represented a significant change in the teachers' opinion about their own voice (p-value: 0.013).

Table 3. Comparison of vocal symptoms and voice satisfaction before and after educational intervention mediated by technologies in the vocal health of teachers in the municipal public elementary school network in the city of Cuiabá-MT, 2023

Variables	Pre-intervention n (%)	Post-intervention n (%)	p-value
Vocal symptoms			
Dry throat	26 (86.67)	20 (66.67)	0.070
Hoarseness	22 (73.33)	14 (46.67)	0.039
Tiredness when speaking	18 (60.00)	12 (40.00)	0.109
Voice cracks	16 (53.33)	9 (30.00)	0.118
Deep voice	14 (46.67)	10 (33.33)	0.388
Dry cough	14 (46.67)	9 (30.00)	0.267
Pain when speaking	12 (40.00)	7 (23.33)	0.062
Throat clearing	11 (36.67)	7 (23.33)	0.219
Loss of voice	10 (33.33)	2 (6.67)	0.021
Pain when swallowing	7 (23.33)	4 (13.33)	0.250
Cough with secretion	5 (16.67)	5 (16.67)	1.000
Throat secretion	5 (16.67)	6 (20.00)	1.000
Voice satisfaction			
Very satisfied or satisfied	12 (40.00)	22 (73.33)	**0.013**
Neither dissatisfied nor satisfied, dissatisfied or very dissatisfied	18 (60.00)	8 (26.67)	

Legend: McNemar's test considering statistical significance for p-value ≤ 0.05.

In Table 4, it can be seen that there was a significant reduction in the SIVD median (pre= 5.00; post= 2.5, p-value: <0.001).

Table 4. Comparison of the Screening Index for Voice Disorders (SIVD) pre- and post-technology-mediated educational intervention in the vocal health of teachers in the municipal public elementary school system in the city of Cuiabá-MT, 2023

SIVD	Mean	Median	SD	p-value
Pré	5.33	5.00	2.84	**<0.001**
Post	3.46	2.50	3.22	

Legend: Wilcoxon test considering statistical significance for a p-value ≤ 0.05. SD = Standard Deviation.

Discussion

The present study aimed to analyze the effects of an educational intervention mediated by technologies on the vocal health of elementary school teachers in the city of Cuiabá-MT. The majority of the teachers were female, aged 50 to 63 years, of mixed race/skin color, had a partner, worked in a school, had over 15 years of teaching experience, and spent 40 hours or more per week with students.

Similarly, a study aimed to investigate factors associated with the impairment of quality-of-life domains in elementary school teachers in the city of Cuiabá-MT involved the participation of 326 teachers, the majority of whom were female, with an average age of 43.01 years, lived with a partner, taught in a single school, and worked between 21-40 hours per week with students[23].

Regarding vocal habits, teachers maintained their behaviors after the intervention, such as talking a lot, telling stories, singing in class, speaking in open spaces, and shouting. The literature indicates that changing habits is a difficult task, as it requires cognitive effort and is directly influenced by stress levels, which, when high, increase the occurrence of inappropriate behaviors[24]. Changes in vocal behaviors occur gradually, and awareness should be

raised continuously to prevent the emergence and/or worsening of voice disorders among teachers.

Vocal habits were addressed in a study conducted in Turkey with elementary and/or high school teachers who underwent vocal screening and were considered to have "non-normal voices". During the intervention, they received guidance on vocal hygiene via videoconference in a single meeting. Four weeks later, they were reassessed and reported positive changes in vocal behavior, including "avoiding smoking", "drinking enough water daily", "eating healthy foods", "avoiding excessive meals", and "avoiding frequent throat clearing". However, the training was not enough to change the status of teachers to "normal voices"[25].

The vocal habits of shouting and talking a lot were also self-reported in a study conducted with 46 teachers from the public school system in the state of Sergipe, divided into group A, who worked in one school, and group B, who worked in two or more schools. The groups obtained, respectively, shouting with 52.1% and 82.6%, talking a lot with 91.3% and 95.6%, and speaking in open spaces with 56.5% and 86.9%[26].

Also, regarding vocal habits, in the present study, most teachers practiced the habit of hydrating themselves, even before the intervention. Similarly, a study conducted with 162 teachers from the municipal school system in São Paulo found that the participants also had knowledge about the importance of hydration, even before receiving vocal training[6]. The authors attributed this result to actions to promote vocal health and speech therapy treatments that constantly address the topic. The literature reinforces that hydration can promote the reduction of vocal symptoms, provide a clearer voice and ease in speaking[27].

In relation to vocal care, after the intervention, teachers reported taking more vocal rest, warming up and cooling down their voices. However, an intervention study through a distance learning course with eight modules and three face-to-face meetings (total of 40 hours) in São Paulo observed that vocal warm-up and cool-down exercises and resonance exercises were practiced by a lower number of subjects than expected[6]. The authors attributed the lack of success to low adherence by teachers and proposed that the monitoring strategies of teachers and tutors of the distance learning course on vocal health be reviewed.

In contrast, a qualitative and descriptive study on health education actions that were carried out from 2014 to 2019, developed in the municipality of Itapajé - CE, with 15 face-to-face meetings in the form of a conversation circle, addressing vocal care and preparation, through vocal warm-up and cool-down exercises, noted that the intervention over the years helped prevent vocal disorders, provided learning about the subject, contributing to healthier work activity[16].

Regarding vocal symptoms, there was a significant reduction in hoarseness and loss of voice. Hoarseness is caused by irregular vibration of the vocal folds, making the voice low and weak[28]. Regarding loss of voice, this can occur due to the presence of lesions in the vocal folds and fatigue of the laryngeal muscles[11].

A scoping review with the objective of mapping and analyzing studies on interventions in teachers' voice, published in Brazilian Speech-Language Pathology journals, from January 2011 to March 2021, showed that among the 18 articles included, there was a reduction in vocal symptoms, such as hoarseness, effort when speaking, throat clearing, pain, neck tension and a reduction in the degree of discomfort[29].

Corroborating these findings, researchers responsible for a voice training program with the aim of evaluating its long-term effectiveness, conducting 27 sessions with 286 teachers from the state school system in Germany, observed an improvement in vocal resistance (72.2%) three months after the intervention. This included less throat clearing (80.6%) and/or a reduction in symptoms of vocal tract discomfort (66%)[30].

As for the Screening Index for Voice Disorders (SIVD), there was a significant reduction in the median from five points before to 2.50 points after. This data is relevant, since the authors of the SIVD[16] consider the cutoff score to predict a probable voice disorder to be a score equal to or greater than five points, with participants having a better score after the intervention. In comparison, an intervention study conducted with 29 teachers from Salvador (BA) over four weeks also found a significant reduction in the median of the SIVD from 4.00 points to 1.00 point after the intervention, indicating an improvement in the voice and less self-reported vocal fatigue[13].

Finally, the present study found a significant change in satisfaction with the voice, with the ma-

jority being "very satisfied or satisfied" after the vocal intervention. This finding is relevant, since teacher dissatisfaction may be associated with symptoms of common mental disorders, musculoskeletal symptoms, voice disorders, and lack of physical activity/sports[30]. Measuring satisfaction is relevant, since it allows for a qualitative analysis of teachers' opinions about vocal health programs and their own voice, and can serve as a guide for future interventions.

Regarding the intervention in this study, it occurred synchronously, allowing the teacher convenience, being able to do it from home; cost reduction, not having to travel to a meeting place; maintenance of the sense of group and support network, with the remote participation of teachers from the same school, encouraging peer support; knowledge about the anatomy and physiology of the voice, which is the teacher's main work tool; reflection on habits and behaviors, aiming at changing them; and the practice of vocal exercises, for better vocal conditioning and symptom reduction.

However, not all teachers were able to complete the vocal health training, as shown in the dropout data shown in Figure 1, some due to having to take the course during their rest period, having had to switch to other activities (exercising physical activities, going to church and participating in events) and due to the difficulty in maintaining an internet connection during the intervention. Finally, in a discussion with the teachers, they suggested that, in order to increase adherence to vocal health training, it would be important to hold the meetings during activity time, which corresponds to the time set aside for extracurricular activities in the school itself, which would facilitate access to the internet using the technological infrastructure of the work environment and during working hours, while maintaining rest hours.

Finally, it is suggested that more actions be carried out to promote vocal health for teachers, since even with the positive results of the intervention, it was not enough to change some vocal behaviors. In this sense, ongoing training with speech therapy monitoring in close proximity to the teacher is important, with Information and Communication Technology being an ally in the prevention of work-related voice disorders.

Conclusion

It is concluded that the educational intervention mediated by technologies in the vocal health of elementary school teachers allowed a significant increase in vocal care, with a greater number of teachers performing vocal rest, vocal warm-ups and cool-downs after the intervention. In addition, it allowed a significant reduction in vocal symptoms (hoarseness and loss of voice) and in the average Screening Index for Voice Disorders (SIVD). However, even after the intervention, the teachers maintained their vocal habits, requiring continued training in vocal health.

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