



# Relationship between noise in classroom perception self-reported by university teachers and its influence for the voice

Relação entre percepção de ruído em sala de aula autorreferida por professores universitários e suas consequências sobre a VOZ

Relación entre la percepción de ruido en el aula auto referida por profesores universitarios y sus consecuencias sobre la VOZ

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## **Abstract**

**Purpose:** To relate the presence of self-reported classroom noise with voice disorders in teachers.  
**Methods:** 79 university teachers took part in this research, out of which 59 (74.68%) were female and 20 (25.32%) male, with the average age being 49 years old, which related in a questionnaire that the

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work place was noisy, A voice sample for each teacher was then collected and analyzed by means of the GRBASI scale. The noise complaint was then compared with self-reported voice alteration and speech therapy, perception-hearing evaluation's results. **Results:** all the teachers complained of the presence of noise. In regards to speech, 48.10% mentioned voice-alteration. The quantity of vocal symptoms varied and the co-relation between a self-reported vocal disorder with four or more symptoms was significant ( $p=0,0018$ ). Vocal evaluation, done utilizing the GRBASI scale identified 27.42% of voices altered when related to noise complaint, however very mildly and without a significant statistical impact. **Conclusion:** the so mentioned noise in the classroom was very prevalent in this research, although, when correlated with vocal alteration, no significant association was found.

**Palavras-chave:** voice; noise effects; voice disorders; faculty.

## Resumo

**Objetivo:** Relacionar percepção de ruído em sala de aula autorreferida e alteração vocal em professores. **Método:** Participaram 79 professores universitários, com média de idade de 49 anos, sendo 59 (74,68%) do sexo feminino e 20 (25,32%) do masculino, que referiram ambiente de trabalho ruidoso em um questionário. Captou-se uma amostra da voz de cada docente e a mesma foi analisada, utilizando a escala GRBASI. Compararam-se os resultados da queixa de ruído com a alteração vocal autorreferida e o resultado da avaliação fonoaudiológica perceptivoauditiva. **Resultados:** todos os professores queixaram-se da presença de ruído, porém apenas 48,10% deles mencionou alteração vocal. O número de sintomas vocais variou e foi significativa a associação entre autorreferência à alteração vocal e quatro sintomas ou mais ( $p=0,0018$ ). A avaliação vocal utilizando a escala GRBASI identificou 27,42% das vozes como alteradas, em especial em grau discreto, sem significância estatística quando relacionada à queixa de ruído. **Conclusão:** A autorreferência ao ruído em sala de aula foi muito prevalente nesta pesquisa, porém quando relacionada à alteração vocal, não foi encontrada associação significativa entre elas.

**Keywords:** voz; efeitos do ruído; distúrbios da voz; docentes.

## Resumen

**Objetivo:** Relacionar la percepción auto referida del ruido en el aula y la alteración vocal en profesores. **Método:** Participaron 79 profesores universitarios, con un promedio de edad entre los 49 años de edad, siendo 59 (74,68%) del sexo femenino y 20 (25,32%) del masculino, que refirieron un ambiente de trabajo ruidoso en un cuestionario. Se captó una muestra de la voz de cada docente que se analizó utilizando la escala GRBASI. Se compararon los resultados de queja sobre ruido, alteración vocal autor referida y evaluación fonoaudiológica perceptivo-auditiva. **Resultados:** todos los profesores se quejaron por la presencia de ruido, pero solo 48,10% de ellos mencionó alteración vocal. El número de síntomas vocales varió y fue significativa la asociación entre auto referencia, alteración vocal y cuatro síntomas o más ( $p=0,0018$ ). La evaluación vocal utilizando la escala GRBASI identificó el 27,42% de las voces como alteradas, en especial en grado discreto, sin significancia estadística cuando relacionadas a la queja de ruido. **Conclusión:** La auto referencia al ruido en el aula fue prevaleciente en este estudio, sin embargo, cuando relacionada con la alteración vocal, no se encontró asociación significativa.

**Palabras clave:** Voz; Efectos del Ruído; Transtornos de la Voz; Docentes.

## Introduction

Studies that seek to understand the relationship between the work and health of teachers have shown that risk factors of various natures may harm their health and voices. The factors concerning the work environment, dust, chalk powder, inappropriate ventilation and lighting have been a constant cause of complaint by teachers<sup>1,2</sup>.

One factor that has been receiving special attention from researchers are the high levels of noise observed in school institutions, due to its harmful consequences on the health of the entire school community, shown by auditory and non-auditory symptoms<sup>3,4</sup> such as stress, lack of concentration, irritability and also for its possibility of interference in the voice of teachers.

When teaching in a noisy environment, the teacher usually chooses to elevate his/her voice intensity, which may harm the larynx and the vocal folds, and favor the appearance of unpleasant throat sensations as well as voice quality disorders such as hoarseness, low pitch and difficulty with voice modulation, sometimes leading to its complete loss, causing serious damage to work and their careers<sup>5-12</sup>.

The voice's importance for teachers is notorious, with an essential component in the teaching-learning process<sup>13</sup> and thus it must be strong and flexible in order to socialize knowledge and keep classroom discipline, which demands integrity of its qualities, and therefore demands adequate phonation.

One study with teachers identified that tone of voice elevation was the main risk factor in the development of voice disorders, and it was four times more present in those with voice complaints, attributed to work conditions and classroom where there were high levels of noise and reverberation<sup>14</sup>. The unhealthy work conditions in the lives of teachers, according to this study, include the reduction of satisfaction at work, decrease in communication skills and speech in phone calls, leading to higher levels of stress and restriction of daily life activities, thus deteriorating quality of life. Therefore, creating strategies and projects that will correct the previous failures in factors causing vocal problems are of the utmost importance for health promotion of teachers.

Elementary and high school levels have been privileged by the studies regarding voice and noise

and voice and health. In these, teachers classify noise as too loud or unbearable<sup>15</sup> and stress that it is one of the greatest problems in the classroom, due to its interference in teachers' performance<sup>16</sup>.

In higher-level education, some studies have been showing that noise also sometimes exceeds intensity limits, and classroom acoustics does not fulfill the basic required criteria<sup>17</sup>, which, when added to other factors, generate inappropriate voice use conditions. In spite of these conditions, teachers do not always use sound amplification, as they feel uncomfortable with the microphone or because this resource is not available at the institution, a fact that cooperates with vocal illnesses<sup>18</sup>.

Noise evaluation in the school may be conducted objectively, using instruments that measure noise in decibel, at different times and places in the school<sup>19</sup>, however, part of the understanding of the relationship between noise and voice is counting on the teacher's perception, since he/she is the one who will use it at work, and will provide an evaluation about it and how each one will singularly react to the professional situation, evaluating the activities being performed as factors of vocal overload or not<sup>20</sup>. In addition, a Speech-Language Pathology and Audiology evaluation is paramount so that, with parameters that have become an international consensus, the presence or absence of voice disorders may be verified and, in it, the more evident characteristics that must be overcome<sup>21-23</sup>.

Therefore, the purpose of this study is to relate the presence of self-reported classroom noise and voice disorder in university teachers.

## Method

The subjects of this study were 79 university teachers who complained about noise in the work environment, of which 21 (24.7%) reported that it was always present and 58 (68.23%) as sometimes present. Age varied between 32 and 74 years, with a mean of 49.33 years; 59 (74.68%) professors were female and 20 (25.32%) were male; 44 (55.7%) had a Ph.D. and 13 (16.46%) had Masters' Degrees.

The option for health field teachers is explained by the fact that this is a field involved in human care, supposedly leading to a greater perception of the teachers about factors that interfere with their health. Furthermore, a decision was made to study professors who shared the same work



environments, therefore with similar environmental characteristics, which proved beneficial in the risk factor analysis, especially for the presence of noise.

The inclusion criteria were being a health course professor and taking part in all procedures of the study; the exclusion criteria were difficulties in contacting the teachers, and schedule divergences with the researchers.

The instrument used in the study was the Conditions of Voice Production – Teacher (CPV-P) questionnaire<sup>24</sup> in an electronic version, made available at the University website. The teachers would access the link to the instrument and would find the Informed Consent Term, and after manifesting their acceptance with its contents, were able to access the space containing the instrument’s questions. From this instrument, the following items were selected: identification (name, age, sex, marital status and schooling), functional situation (presence of noise in the university) and vocal aspects (presence or absence of voice disorder, where “no”, “yes, I’ve had one” and “yes, I have one” were the options offered for answers).

A voice sample of the teachers was recorded using a digital recorder ICD-MX20VTP Sony®. The recording was standardized for all participants so that the teacher was standing up while uttering the vowels /a, /i/ and /u/, the months of the year and spontaneous speech while answering the question “how do you assess your voice?”. The emissions occurred without interruption by the researchers, with the recorder’s microphone placed at a distance of five centimeters from the professors’ mouths.

Each voice was identified and the same number received by the teacher when filling out the questionnaire was maintained. Then, a perceptive auditory

analysis was conducted by the same Speech-Language Pathologist, specialized in voice, who used the GRBASI Scale (G- Grade of Dysphonia, R – roughness B - breathiness, A - asthenicity, S - strain, I - instability)<sup>21,22</sup> and classified the overall grade of dysphonia of each voice as absent (0), mild (1), moderate (2) and intense (3).

The data from the questionnaire were submitted to descriptive statistical analysis for social-demographic characterization of the teachers. The teacher and result of the perceptive-auditory evaluation compared the complaints regarding noise and voice, as well as the results from the Speech-Language Pathology evaluation as follows: self-reported presence of noise and presence or absence of voice disorder according to the CPV-P; number of self-reported vocal symptoms and result of the perceptive auditory evaluation; self-reported presence of noise.

This study is part of a larger project that aimed to relate work conditions and voice of university professors and was approved by the Institutional Research Ethics Committee in 11/12/2009, under number 885/09.

The Chi-square and Fisher’s exact test were conducted in statistical comparisons. The significance value was established at 5%.

## Results

Table 1 shows that even though all teachers had mentioned the presence of noise in the classroom, the same was not true for voice disorders, self-reported by almost half of the participating subjects.

**Table 1 - Self-Reported Presence of Noise and Voice Disorder on the CPV-P**

Noise Complaint		Voice Disorder on the CPV-P			
Yes		Yes		No	
n	%	n	%	n	%
79	92,94	38	48,10	41	51,9

Table 2 compares the frequencies of noise perception by the teachers and the presence or

absence of self-reported voice disorder, without association between them.

**Table 2 – Relationship between Presence of Noise and Voice Disorder on the CPV-P**

Noise Complaint	Voice Complaint				p-Value		
	Não		Yes, I had		Yes, I have		
	n	%	n	%	n	%	
<b>Sometimes</b>	30	73,17	25	75,76	3	60,00	0,775
<b>Always</b>	11	26,83	8	24,24	2	40,00	

\* Fisher's Exact Test -  $p \leq 0.05$

The results of the relationship between number of reported symptoms and self-reported voice

disorder by teachers are shown in Table 3, as well as the significance between these two variables.

**Table 3 – Relationship between the number of vocal symptoms and self-reported voice disorder on the CPV-P**

Number of Symptoms	Self-Reported Voice Disorder on the CPV-P						p-Value
	No		Yes, I had		Yes, I have		
	N	%	n	%	n	%	
0	21	60,00	10	30,30	0	0	
1	5	14,29	3	9,09	0	0	
2	2	5,71	1	3,03	0	0	0,0051*
3	2	5,71	3	9,09	0	0	
4 or more	5	14,29	16	48,48	5	100	

\* Fisher's Exact Test -  $p \leq 0.05$

Table 4 demonstrates the data resulting from the comparison between frequency of self-reported noise by teachers and Speech-Language Pathology

evaluation, with no association between these variables.

**Table 4 – Comparison between self-reported noise and perceptive auditory evaluation**

Self-Reported Noise	Perceptive Auditory Evaluation						p-Value
	No Disorder		Mild Disorder		Moderate Disorder		
	n	%	n	%	n	%	
<b>Sometimes</b>	29	70,73	10	24,39	2	4,88	0,878
<b>Always</b>	14	77,78	3	16,67	1	5,56	

\* Fisher's Exact Test  $p \leq 0,05$ -

## Discussion

All of the teachers participating in this study complain that their work environment is noisy, either systematically (always) or not (sometimes). Thus, the selected subjects already had specific characteristics, different from others that compare teachers with and without this complaint. The interest in analyzing these teachers comes from

the fact that national and international Speech-Language Pathology investigations highlight the great number of teachers who perceive noise as a factor that is harmful to their health and to the use of their voices<sup>2,4,15,19</sup>. The high levels of noise in schools happen in spite of normative documents that determine acceptable noise limits in these environments<sup>25</sup> and of the knowledge about how it is deleterious to learning and health<sup>3,26</sup>. This is

possibly due to the lesser value of Education in our country and, therefore, the small amount of investments destined to it, by the understanding that noise in schools is different from noise in industries, where its harm to hearing is already consolidated, to lack of school inspections and the tolerance of parents and teachers who not always demand a quality school, including this environmental, work and study aspect.

Regarding their voices, almost half of the professors reported disorders (Table 1), which is very similar to the data found by other studies (41.2%)<sup>17</sup>, in higher-level education, however, in smaller frequency when compared to other levels of education (51.2%)<sup>9</sup>, (51.4%)<sup>12</sup>, 53.6%<sup>8</sup> 63.3%<sup>27</sup>, seeming to show that, in general, university professors, even with the multiple tasks they are asked to perform, still find themselves in a more organized and favorable work condition for their voices than those in other levels of education.

The comparison between the teachers who complained about noise and the self-reported presence or absence of voice disorders was not statistically significant (Table 2). One study with teachers found that 60% complained about noise and the frequency of self-reported voice disorder was significantly greater among those who complained about loud to unbearable noise in the classroom and in the school<sup>11</sup>. In spite of the identification of the difficulty in appropriately using their voice in noisy environments such as the classroom, and that its use initially generates uncomfortable throat sensations and, afterwards deterioration of voice qualities, a common situation in schools, it should be recognized that other factors aside noise, present in work organization and environment may interfere in voice production and its health<sup>2,15,16,18</sup>.

Among the teachers who denied voice disorders, more than two thirds did not mention any symptoms, indicating that they use their voices during teaching without difficulties or negative consequences. However, it should be noted that more than one third of this group mentioned vocal symptoms and <sup>14</sup>.29% self-reported four or more symptoms, which may be an indication of voice disorder<sup>28</sup>. In this case, the symptoms seem not to matter much to the teachers, possibly because they occur sporadically and thus are not considered an occurrence that would be a cause for worry (Table 3). Among those subjects who reported voice disorders, the greater part referred four or more

symptoms, which is in accordance with the findings of another study<sup>20</sup> conducted only with teachers who already had voice disorder complaints.

The comparison between the number of vocal symptoms of the teachers with and without self-reported voice complaints was statistically significant, which suggests that the number of symptoms is related to the presence of voice disorders<sup>28</sup>. A global analysis of the results shows that a considerable part of the teachers with or without reports of voice disorders has symptoms, indicating a vocal risk situation. The vocal situation of Brazilian teachers was shown in a study<sup>29</sup> that compared teachers and non-teachers and found higher frequency of complaints of five or more symptoms in the first group. The symptoms were related to work activities and had unfavorable consequences on health, work, and career development.

The comparison between the result of voice evaluation and reports of presence of noise was not significant (Table 4), perhaps because the perceptive auditory assessment showed absence or mild voice disorders in the participating teachers. A study aiming to relate classroom noise, voice intensity and presence of voice disorders in teachers was conducted by measuring noise and evaluating teachers' voices using the GRBASI scale. High levels of noise were detected as well as its correlation to the increase in teachers' voice intensity. However, the high prevalence of disordered voices, classified as moderate disorders, was also not correlated to environmental noise levels<sup>19</sup>. Another investigation that used a questionnaire and perceptive-auditory assessment in 476 teachers of different levels did not find a relationship between classroom noise and voice disorders in teachers<sup>8</sup>, and a study with preschool teachers found high levels of noise in the work environment and found an association between noise and mild/moderate voice disorders<sup>30</sup>. Thus, this noise/voice relationship has been concerning researchers and is present in Brazilian and international studies that seek to assess work and the health of teachers.

These findings reinforce the constant and intense presence of noise in schools and classrooms of the different education levels but, however, it is not Always possible to correlate it with voice disorders of teachers that should be understood as extremely complex and as a product of multiple factors, and may not be captured in a single, unique way. The use of different methods to assess

this relationship also makes comparisons, as well as a more objective and solid view of this matter, more difficult

Finally, the limitations of this study should be considered. One of them is the fact that investigating a sample of teachers, who were all submitted to noise during teaching, but with different frequency (always and sometimes), which is different from others that compared this factor regarding its simple presence or absence.

Another issue that should be explained is that fact that, differently from usual practices, this study did not use any equipment to measure noise that would provide important numerical data. The decision to consider the teacher's perception of noise as a reference was based on the fact that the assessment and reaction to classroom noise may be different when consider the subjectivity of those involved. A conversation among students may be considered tolerable by one teacher and unbearable by another. Therefore, in unfavorable health conditions, specifically regarding voice, the teacher's reaction may be related to his relationship with his job, his level of satisfaction with it, in a context where many variables are involved, generating particular results.

It should be noted that this is a cross-sectional study, therefore without pretention of defining a cause-effect relationship between noise and voice disorder. Its results, however, enable the analysis of different sides of this relationship and enhance the Speech-Language Pathologist's, and other health professionals', understanding about the presence of noise and its effects in higher-level education institutions

## Conclusion

Self-reported classroom noise was prevalent in this study, with no significant association when related to voice disorder. This fact shows that voice disorders occur from a series of environmental and organizational factors, noise being one of these.

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