

Effects of noise at school: perception of kindergarten and elementary school teachers I and II who work in private schools in Vale do Itajaí

Efeitos do ruído na escola: percepção de professores do ensino infantil e fundamental I e II que atuam em escola privada no Vale do Itajaí

Efectos del ruido en la escuela: percepción de los profesores de jardín de infancia y escuela primaria I y II que actúan en escuelas privadas del Vale do Itajaí

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Abstract

Introduction: exposure to noise in the school environment can cause discomfort, being identified as one of the factors related to learning and concentration difficulties. **Objective:** to define the relationship between exposure to noise and auditory and non-auditory effects on the perception of teachers of kindergarten and elementary education I and II in a private school in Vale do Itajaí. **Methodology:** data collection using an online questionnaire answered by 29 teachers, containing multiple choice questions, with descriptive statistical analysis. **Results:** 89.66% of teachers have a weekly working day of more

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Authors' contributions:

TLS, DM: study conception, methodology, data collection, article design.

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than 20 hours/class; 20% perceive the presence of noise at school, which is of moderate intensity; 68.97% pointed to the students themselves as the main source of noise and 62.07% to recess and the sports court; 41.4% perceive health losses, but are unaware of the existence of regulatory standards regarding noise at school; 100% report symptoms of stress, anxiety, irritability and/or insomnia and 68.96% relate these to noise exposure; 34.48% notice worsening of symptoms after classes; 55.17% never received information or participated in activities about noise, although 86.21% “made arrangements” [established rules] with students to minimize the effects of noise in the school environment. **Conclusion:** the effects of noise at school are noticed by teachers, especially during class breaks, with symptoms of stress, anxiety, irritability and/or insomnia being the most cited.

Keywords: Education; Noise; Teachers; Effects of Noise; Occupational Health.

Resumo

Introdução: a exposição ao ruído no ambiente escolar pode gerar desconforto, sendo apontada como um dos fatores relacionados às dificuldades de aprendizagem e concentração. **Objetivo:** definir a relação entre a exposição ao ruído e os efeitos auditivos e não auditivos na percepção de professores do ensino infantil e fundamental I e II em uma escola privada no Vale do Itajaí. **Metodologia:** coleta de dados com aplicação de questionário *online* respondido por 29 professores, contendo perguntas de múltipla escolha, com análise estatística descritiva. **Resultados:** 89,66% dos professores têm jornada de trabalho semanal superior a 20 horas/aula; 20% percebem a presença de ruído na escola, sendo esta de intensidade moderada; 68,97% apontaram como principal fonte de ruído os próprios alunos e 62,07% o intervalo e a quadra de esportes; 41,4% percebem prejuízos na saúde, porém desconhecem a existência de normas regulamentadoras sobre o ruído na escola; 100% relatam sintomas de estresse, ansiedade, irritabilidade e/ou insônia e 68,96% relacionam estes com a exposição ao ruído; 34,48% percebem agravos dos sintomas após as aulas; 55,17% nunca receberam informações ou participaram de atividades sobre o ruído, embora 86,21% “fazem combinados” [estabelecem regras] com os alunos para minimizar os efeitos do ruído no ambiente escolar. **Conclusão:** os efeitos do ruído na escola são percebidos pelos professores, principalmente no intervalo das aulas, sendo os sintomas de estresse, ansiedade, irritabilidade e/ou insônia os mais citados.

Palavras-chave: Educação; Ruído; Docentes; Efeitos do Ruído; Saúde do Trabalhador.

Resumen

Introducción: la exposición al ruido en el ambiente escolar puede causar malestar, identificándose como uno de los factores relacionados con las dificultades de aprendizaje y concentración. **Objetivo:** definir la relación entre la exposición al ruido y los efectos auditivos y no auditivos en la percepción de profesores de jardín de infantes y educación primaria I y II en una escuela privada del Vale do Itajaí. **Metodología:** recolección de datos mediante cuestionario en línea respondido por 29 docentes, que contiene preguntas de opción múltiple, con análisis estadístico descriptivo. **Resultados:** el 89,66% de los docentes tienen una jornada laboral semanal superior a 20 horas/clase; El 20% percibe la presencia de ruido en el colegio, el cual es de intensidad moderada; El 68,97% señaló a los propios alumnos como principal fuente de ruido y el 62,07% al recreo y la cancha deportiva; El 41,4% percibe pérdidas en la salud, pero desconoce la existencia de normas regulatorias en materia de ruido en la escuela; El 100% reporta síntomas de estrés, ansiedad, irritabilidad y/o insomnio y el 68,96% los relaciona con la exposición al ruido; el 34,48% notan empeoramiento de los síntomas después de clases; El 55,17% nunca recibió información ni participó en actividades sobre ruido, aunque el 86,21% “hizo arreglos” [estableció reglas] con los estudiantes para minimizar los efectos del ruido en el ambiente escolar. **Conclusión:** los efectos del ruido en la escuela son notados por los profesores, especialmente durante los recreos de clase, siendo los síntomas de estrés, ansiedad, irritabilidad y/o insomnio los más citados.

Palabras clave: Educación; Ruido; Docentes; Efectos del Ruido; Salud Laboral.



Introduction

Noise contributes to the development of auditory changes and, in addition to making the environments unpleasant, it is considered a risk factor for the well-being and health of the general population¹.

In schools, the presence of noises from the environment or from the students themselves is associated with learning difficulties, in addition to negatively interfering with communication².

Exposure to noise in classrooms has not been receiving due attention since, when excessive, it can compromise learning and lead to changes in the teachers' health³, causing voice abuse and increased stress levels²⁰ and interfering with well-being and quality of life⁴.

Schools are a learning environment that require attention and concentration, but they are considered a place that generates noise, such as children running, playing and speaking at the same time, sound signaling systems to determine the class times, and noises from fans, air conditioning equipment and sports courts, among others⁵.

A study conducted in Brazilian schools⁶ observed that occupational noise was reported by 33% of the teachers, presenting a positive correlation with reports of agitation and verbal violence and a perception of working in a highly demanding environment. In the same study⁶, the authors mentioned the need to adopt intervention measures to reduce the noise levels and improve the teaching conditions, thus minimizing the effects of noise on teachers' health.

Noise exposure is known to change normal hearing conditions and generates symptoms such as hearing loss, tinnitus and vestibular disorders, as well as "nervousness", anxiety, difficulty concentrating and communicating, aggressiveness and low performance¹.

With regard to teachers' health, it is important to emphasize voice health care; however, auditory injuries and the various non-auditory biological changes caused by exposure to noise in the school environment also interfere in the social, personal and professional spheres⁷.

Loud noise and its impact on teachers' work and health should serve as the basis for developing and implementing educational and structural actions capable of reducing noise levels in the school environment and of providing acoustic comfort, well-being and improved quality of life^{2, 8}.

Therefore, the objective of the current study was to define the relationship between exposure to noise and auditory and non-auditory effects on the perception of Kindergarten and Elementary Education I and II teachers at a private school in Vale do Itajaí.

Methodology

This observational study with a quantitative, descriptive and cross-sectional approach involved the application of an online questionnaire to Kindergarten and Elementary Education I and II teachers working at a private school in Vale do Itajaí and was approved under opinion No. 5,408,332 of the local Research Ethics Committee.

The study population consisted of 84 Kindergarten and Elementary Education I and II teachers of the aforementioned school; however, the final sample comprised 29 teachers that accessed the online questionnaire and agreed to participate by checking "I accept" in the Informed Consent Form (ICF).

The teachers were contacted by email and subsequently by a printed invitation with a QR code to access the ICF and the questionnaire, which was available for completion during 5 months.

The questionnaire consisted of 36 multiple-choice (closed) questions, with the possibility of giving supplementary details freely on the "Others" item, when available in the question. The teachers were allowed to start filling out the questionnaire and continue it later, finishing it only when clicking "Send".

The variables collected were the following: environmental working conditions; perception of noise and its causes; health and lifestyle; presence of noise-related voice complaints; presence of auditory and non-auditory complaints; perception of mental fatigue and stress; and perception of the relationship of health changes attributed to noise in the in-person and remote learning modalities. The questionnaire used was the same that was applied at a public school in Médio Vale do Itajaí, state of Santa Catarina⁹.

Using data from the questionnaire answered on the Microsoft Forms software, an Excel spreadsheet was created for the statistical descriptive analysis, with calculation of absolute and relative frequencies and sample mean.

Results

This study had a sample of 29 teachers, which accounted for 33.72% of the school faculty, including 22 (75.86%) women and 7 (24.13%) men, with 17 (58.62%) participants aged from 20 to 40 years old, and 12 (41.38%) from 40 to 60 years old.

In relation to the school system, 82.75% only work in the private network, and 75.86% do so as Elementary School teachers, with at least ten years of working time in the teaching (51.72%) and weekly working hours of more than 20 hours/class (89,66%).

The teachers' perception about the presence of noise in the school and its intensities is presented in Table 1.

Table 1. Teachers' perception about the presence of noise in the school and its intensities

Noise intensity	Perception of noise in the school			
	Yes	No	Sometimes	Total
Weak	1	1	3	5
Moderate	13	0	7	20
Strong (loud noise)	4	0	0	4
Total	18	1	10	29

The noise sources mentioned by the teachers are presented in Table 2.

Table 2. Noise sources in the school according to the teachers' perception

Perceived noise sources	Yes		No	
	N	%	N	%
The students themselves	20	68.97	9	31.03
Recess and sports court	18	62.07	11	37.93
Air conditioning equipment and room reverberation	15	51.72	14	48.28
Traffic noise	6	20.69	23	79.31

Key: N = Absolute Frequency; % = Relative Frequency

The teachers' perception about whether excessive noise is harmful to health or not and about the existence of regulatory standards (Brazilian Techni-

cal Standards Association [*Associação Brasileira de Normas Técnicas, ABNT*]) for maximum noise level at schools is presented in Table 3.

Table 3. Teachers' perception about health harms caused by excessive noise and existence of regulatory standards regarding noise in schools

Excessive noise is harmful to health	Regulatory standards		
	Yes (%)	No (%)	Total (%)
Yes	8 (27.6)	12 (41.4)	20 (69)
Sometimes	0	8 (27.6)	8 (27.6)
No	0	1 (3.4)	1 (3.4)
Total	8 (27.6)	21 (72.4)	29 (100)

Key: Absolute frequency (Relative frequency)

The presence or absence of auditory and non-auditory effects resulting from the exposure to noise reported by the participants is shown in Table 4.

Table 4. Auditory and non-auditory effects resulting from the exposure to noise reported by the teachers

Auditory and non-auditory symptoms	Yes		No	
	N	%	N	%
Stress, anxiety, irritability and/or insomnia	29	100	0	0
Vocal fatigue	18	62.07	11	37.93
Headache and/or generalized tiredness	18	62.07	11	37.93
Hearing loss, comprehension difficulties and/or tinnitus	13	44.83	16	55.17
Health conditions (gastrointestinal, circulatory or cardiac)	6	20.69	23	79.31

Key: N = Absolute Frequency; % = Relative Frequency

It is noted that 68.96% of the participants associated auditory and non-auditory effects with exposure to noise; the perception about the intensification of these symptoms after classes is presented in Table 5.

Table 5. Perception about the intensification of the auditory and non-auditory symptoms after classes, as reported by the teachers

Intensification of the symptoms after classes	Yes		No	
	N	%	N	%
Hoarseness and vocal fatigue	10	34.48	19	65.52
Stress, anxiety and irritability	7	24.14	22	75.86
Tiredness and headache	5	17.24	24	82.76

Key: N = Absolute Frequency; % = Relative Frequency

Besides exposure to noise in the school, the teachers reported that noise at their homes also affects health, with 74.19% mentioning that it interferes with concentration, and 12.90% that it affects daily activities and compromises speech intelligibility.

In order to investigate whether teachers adopted varied practices to minimize the effects of noise in the school environment, it was first sought to know whether they participated in campaigns, programs or guidelines to reduce noise and promote hearing health in the school setting, revealing that most of them (55.17%) reported having never received information or participated in this type of activity. Even so, the teachers reported adopting practices to minimize the effects of noise in the school environment, such as: “arrangements with the students”, defined as establishing rules to

control noise (86.21%); use of resources to reduce reverberation and internal noise sources, such as putting felts on the feet of chairs, closing windows and not turning the fans or air conditioning equipment on (68,96%); using a microphone (34.48%); and promoting improvements in classroom acoustics (10.34%).

Discussion

The participation rate in our research was 33.72%, a percentage lower than the one observed by Pereira and Mello-Silva¹⁰, who found a response rate of 46.9% and more than ten years of working time in the teaching area, similar to that reported by Libardi *et al.*¹¹, which was 14 years.

There was a considerably higher participation of women (75.86%), which was also observed in other studies^{11, 12, 13, 14, 15, 1, 16, 8}, but diverging in two. In the first¹⁷, the teachers' gender distribution was equal (50% men and 50% women) and, in the second¹⁰, there was greater participation of men than of women; there have been reports⁸ of more women working in public schools (49.1%) and of men doing so in private schools (54.35%), a fact that differs from the one found in the current research, which was conducted in a private institution but had greater participation of women.

In relation to age, our results are similar to those of several studies^{10, 12, 17}, although others^{11, 14, 1, 16} point to an older age group, over 40 years old.

Most of the teachers that answered the questionnaire (82.75%) only work in private schools; however, scientific publications note that most of them work both at public and private institutions^{16, 8}. Of the teachers that took part in the study, 75.86% were Elementary School teachers, as was the case in the literature conducted^{11, 1, 18, 8}, with weekly working hours of 20 hours/class.

A total of 62.06% of the teachers perceived presence of noise in the school at all times, whereas 34.48% only did so in some situations (Table I), a finding that is line with previous studies^{13, 14, 1, 16}.

Noise intensity was perceived as moderate by most of the teachers (68.96%) (Table I), a percentage that is lower than the one obtained in other studies^{11, 12, 14, 5, 2, 6, 19}; the students themselves were the main noise (68.97%), followed by noise generated in recesses and at the sports courts (62.07%) (Table II). A study conducted in São Paulo¹² indicated similar noise sources: from the students and from the classrooms themselves. However, in this study¹², which took place in the central region of the city of São Paulo, external noise represented a noise source in the school environment.

A total of 41.38% of the teachers are not aware of the Regulatory Standards for noise levels in classrooms, although 69% of them consider that excessive noise is harmful to health (Table III).

Regulatory standard NBR 10152 (ABNT, 2020) points out that, for schools, the maximum acceptable reference values are 40 dB in classrooms and 55 dB in circulation areas.

The fact that 69% of the teachers consider that excessive noise is harmful to health is reported in the literature^{2, 4, 6, 12, 13, 20, 21}. The Teachers are aware of the effects of noise on health and recognize that

it is associated with hearing loss, but they do not perceive noise as an occupational risk¹³.

The literature points to the need to adopt intervention measures in the school environment in order to reduce the noise levels and, consequently, to improve the teaching conditions and minimize the effects of noise on teachers' health⁶.

In the current study, 100% of the teachers reported presence of stress, anxiety, irritability and/or insomnia, symptoms related to emotional health and considered non-auditory effects of exposure to excessive noise. In turn, auditory symptoms were reported by 44.83% of the teachers (Table IV).

The auditory and non-auditory effects of exposure to noise are mentioned in the Brazilian literature^{11, 12, 13, 14, 5, 2, 15, 1, 16, 17, 9}, as teachers from different places in the country mention voice changes as the main consequence of exposure to noise in the classroom, including: vocal discomfort; pain when speaking; dryness; irritation; sensitivity; itching; burning sensation; feeling of "lump in the throat"; hoarseness; voice failure; hoarse voice; throat clearing; nodules; polyps; and/or folds on vocal cords, as well as tiredness and burning in the larynx after classes.

The effects of noise on oral communication in the classroom lead teachers to raise their voice and hinder communication with the students^{11, 2, 5}.

The auditory symptoms of exposure to noise were seldom mentioned by the teachers in the current study; however, the literature^{11, 2, 5} includes reports of ear fullness and reduced auditory acuity.

On the other hand, the presence of stress, anxiety, irritability and/or insomnia, considered non-auditory symptoms, was mentioned in previous studies^{11, 2, 5, 22}, where the following conditions stand out: systemic arterial hypertension; excessive tiredness; emotional exhaustion; and digestive or circulatory problems.

The teachers mentioned that the symptoms that are intensified after classes are hoarseness and vocal fatigue (34.48%), in line with other studies^{23, 1} reporting worsening of symptoms such as vocal fatigue and vocal tract discomfort after classes, resulting from the impact of noise on teachers' performance, requiring them to raise their voice.

Besides exposure to noise in the school, the teachers reported the presence of noise at their homes, which interferes with concentration (74.19%), affects daily activities (12.90%) and compromise speech intelligibility (12.90%), find-

ings that are coherent with a study² which showed that 40.7% of the teachers lived in noisy areas and were exposed to noise when practicing sports and performing leisure activities (21.7%).

Therefore, the teachers' exposure to noise is not limited to the school environment, which increases concerns with the detrimental effects of noise to their health⁴.

It is known that one of the ways to minimize the effects of noise on health is to adopt varied practices that can be disseminated and learned in guidance programs about noise reduction and hearing health in the school environment. It is noted that the school where the research was conducted is located in a university campus that offers a Speech Therapy Undergraduate Course, which is responsible for several campaigns related to noise at schools; even so, most of the teachers (55.17%) reported that they had never received any information or participated in this type of activity.

However, they reported empirically adopting practices to minimize the effects of noise in the environment, such as "arrangements with the students" [establishing rules] and using resources to reduce reverberation and internal noise sources, which is considered appropriate in the literature^{2, 6, 4, 8}.

Some studies^{2, 6, 4, 8} unanimously show the need to adopt intervention measures in the school environment to reduce noise levels and causes of anxiety, providing acoustic comfort and well-being, with a consequent improvement in the teaching conditions and in the teachers' quality of life.

Finally, it is fundamental to train and monitor education professionals about the topic of "noise at school" and to constantly encourage them to adopt practices that reduce exposure to noise, such as establishing coexistence rules and employing appropriate acoustic resources in the classrooms.

Study limitations

The main study limitation was the teachers' non-adherence to the research, whose sample consisted of a small number of individuals, accounting for 33.72% of the school's faculty.

Final considerations

The current study made it possible to define a relationship between exposure to noise and auditory and non-auditory effects according to the teachers'

perception, with most teachers perceiving noise in the school; they also report non-auditory symptoms associated with exposure to noise, which was intensified after classes.

It is relevant to devise training programs through lectures, videos and printed informational material for teachers and students regarding the negative effects of noise on health and the ways to minimize them, implementing preventive and corrective measures in the school environment, as prolonged exposure can be harmful not only to hearing, but also to health and to school performance.

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