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Study of indoor and outdoor noise in primary schools in teh city of São Paulo, Brazil

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STUDY OF INDOOR AND OUTDOOR NOISE IN PRIMARY SCHOOLS IN THE CITY OF SÃO PAULO - BRAZIL

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NOISE POLLUTION

-  Hearing loss
-  Cardiovascular diseases
-  Diabetes
-  Difficulty in speech intelligibility
-  Low productivity
-  Decreased cognition
-  Other psychological disorders

ACOUSTIC DESCRIPTORS

Non-stationary noise in schools:



external noise such as traffic noise,

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indoor noise.

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Different acoustic descriptors can be used for the characterization of non-stationary noise:

- Sound pressure level (L_p)
- Maximum sound pressure level (L_{pmax})
- Minimum sound pressure level (L_{pmin})
- Statistical level (L_{10})
- Statistical levels (L_{90})
- A-weighted equivalent sound level (L_{Aeq})
- Speech interference level (SIL)

NOISE MEASUREMENT IN EPIDEMIOLOGICAL STUDIES



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- noise level(dB)
- frequency (Hz)



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Other variables:

- time in which the measurement will be performed
- acquisition rate



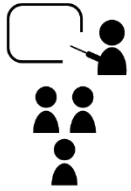
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No clear definition on epidemiological studies:

- noise measurement methods
- and acoustic descriptors



NOISE IN SCHOOL BUILDINGS



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Environment favorable to:

- studying and learning
- the good performance of teachers



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Communication:

- background noise
- reverberation time



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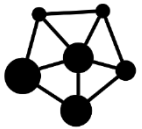
Sources of noise generated internally:

- electronic equipment
- ventilation systems
- building systems
- children in their own classroom, corridors or adjacent rooms

NOISE IN SCHOOL BUILDINGS



Measurement of noise in schools so that they are representative for association with epidemiological studies.



Association of noise levels, predominant frequencies, and the amount of time which they occur.



Objective:

Evaluate internal and external noise in classrooms and compare them with the levels established by legislation, critically analyzing the effects of noise on the learning process of the students.

METHOD

Itens	School A	School B	School C	School D	School E
Number of students	22	30	29	18	30
Floor	1st floor	1st floor	Ground floor	1st floor	Ground floor
Furniture	31	31	33	33	33
Outdoor noise	Air and land traffic	Land traffic	Car workshop	Land traffic	Air and land traffic
Area type	Commercial and residential	Residential	Residential	Commercial and residential	Residential

NOISE LEVEL MEASUREMENTS

A-weighted sound pressure level limits for outdoor environments, in dB [ABNT NBR 10151]

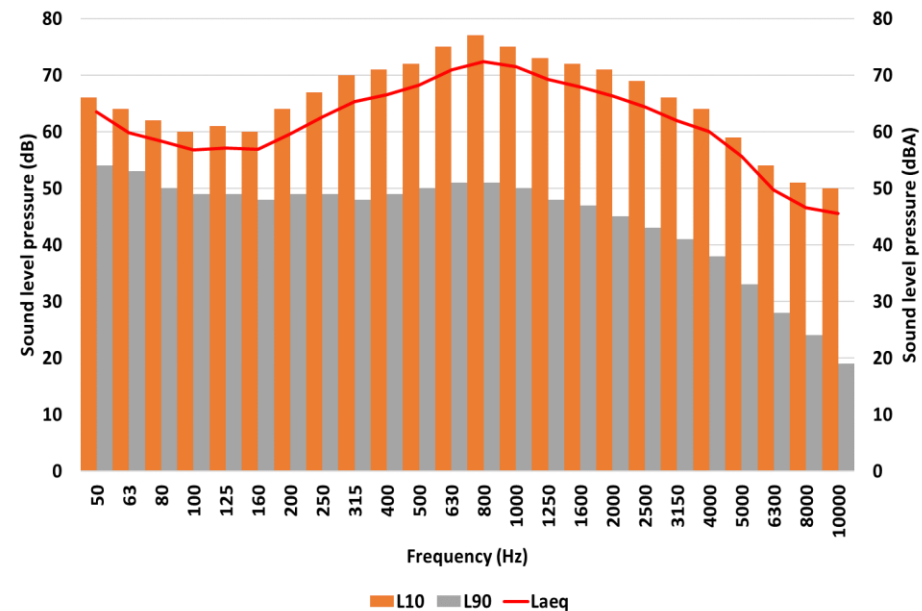
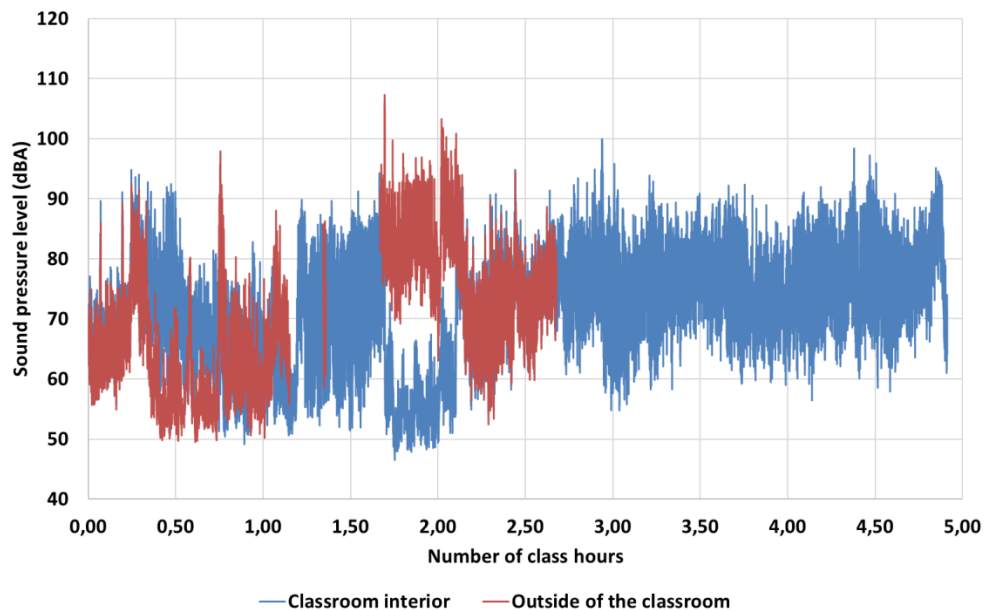
Types of inhabited areas	Sound pressure level limits	
	Daytime	Nighttime
Rural residential area	40	35
Strictly urban residential area or hospital or school area	50	45
Mixed area, predominantly residential	55	50
Mixed area of commercial establishments and offices	60	55
Mixed area with a predominance of cultural, leisure and tourism activities	65	55
Predominantly industrial area	70	60

Data analysis:

- L_p , L_{pmax} , L_{pmin} , L_{10} , L_{90} , L_{Aeq} , SIL

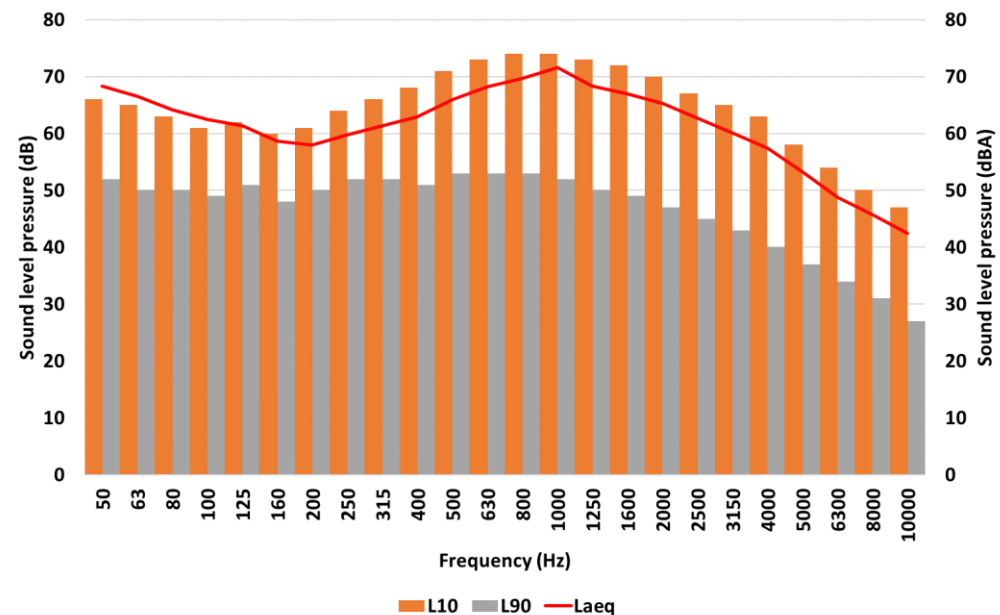
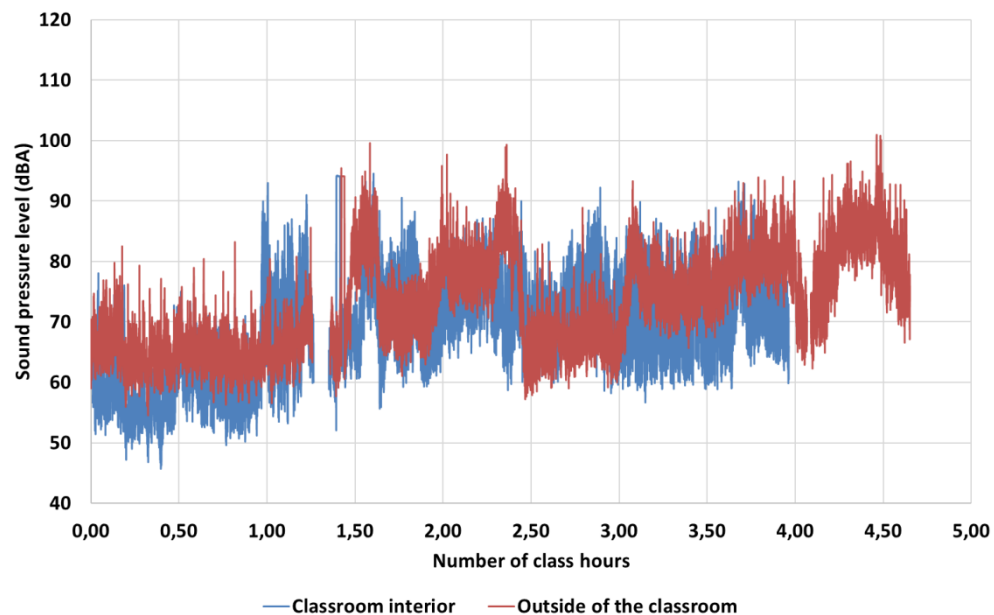
RESULTS

■ School A



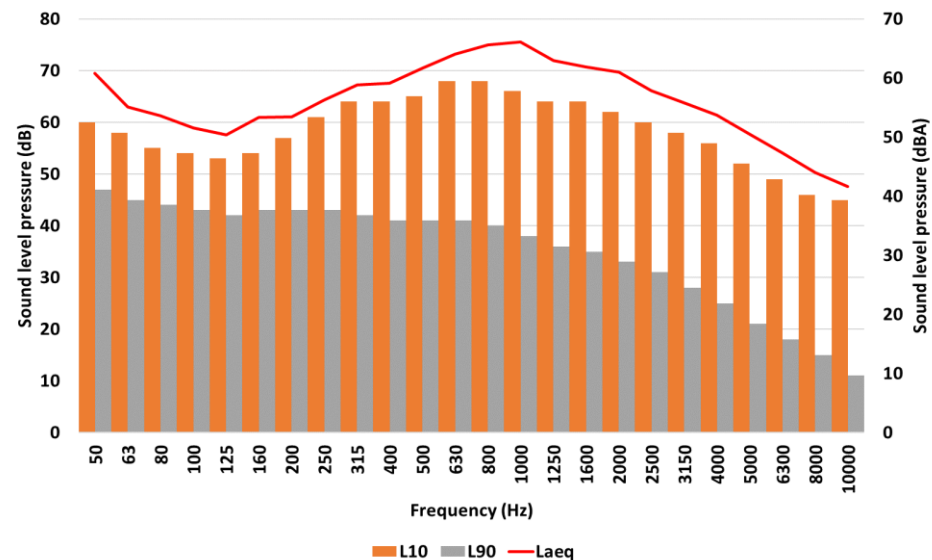
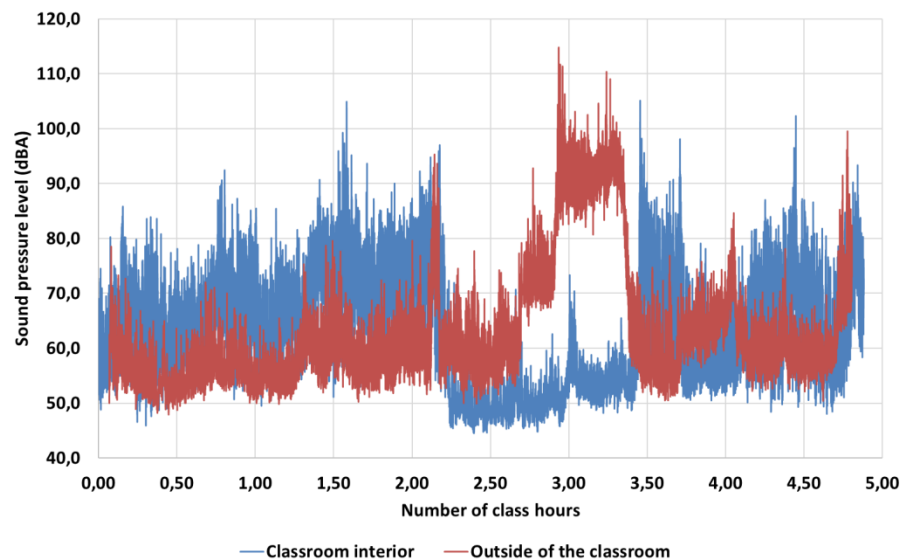
RESULTS

■ School B



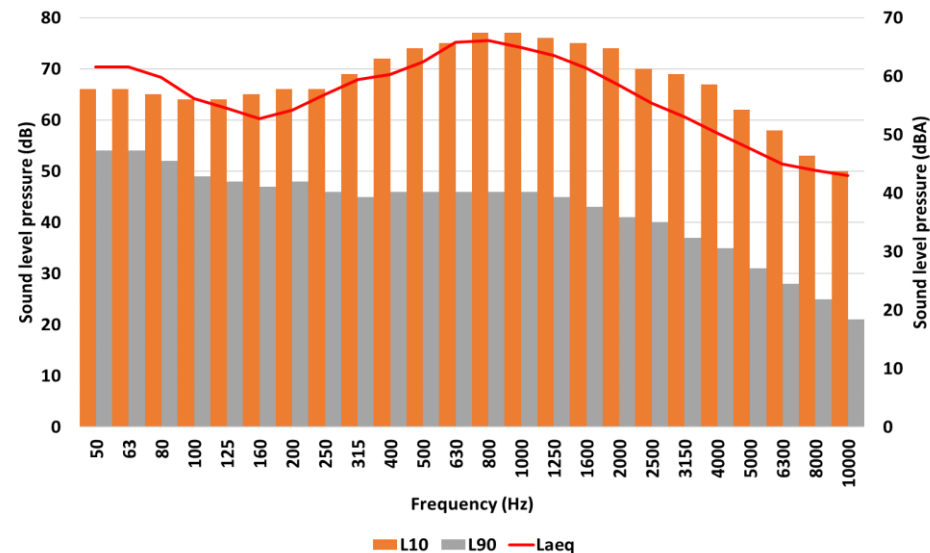
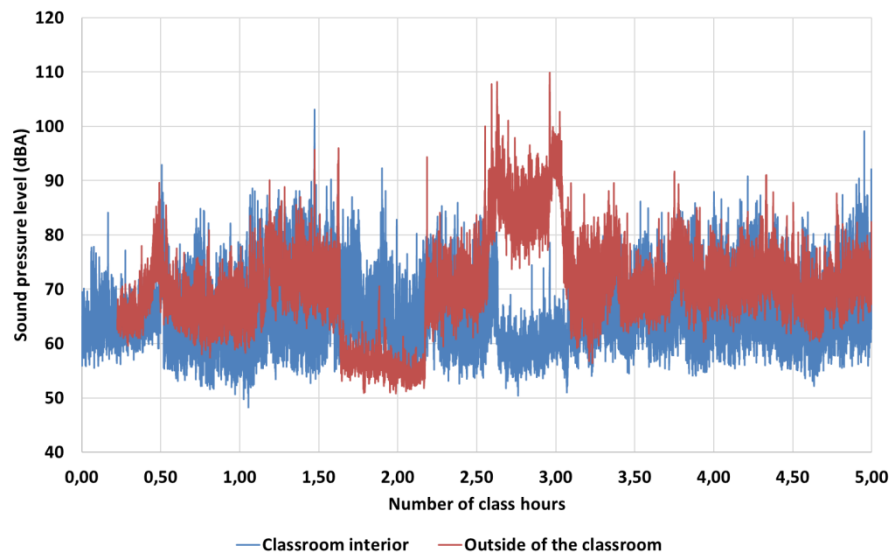
RESULTS

■ School C



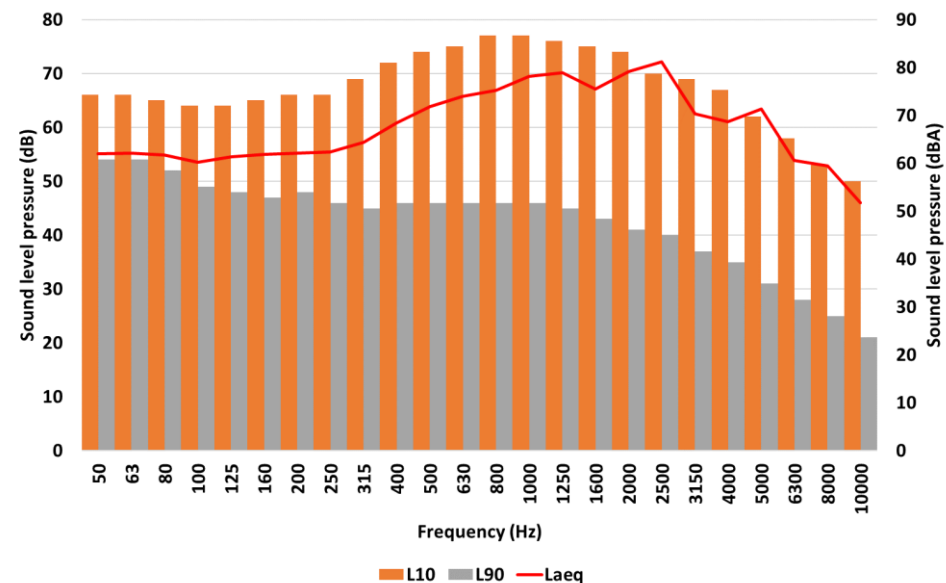
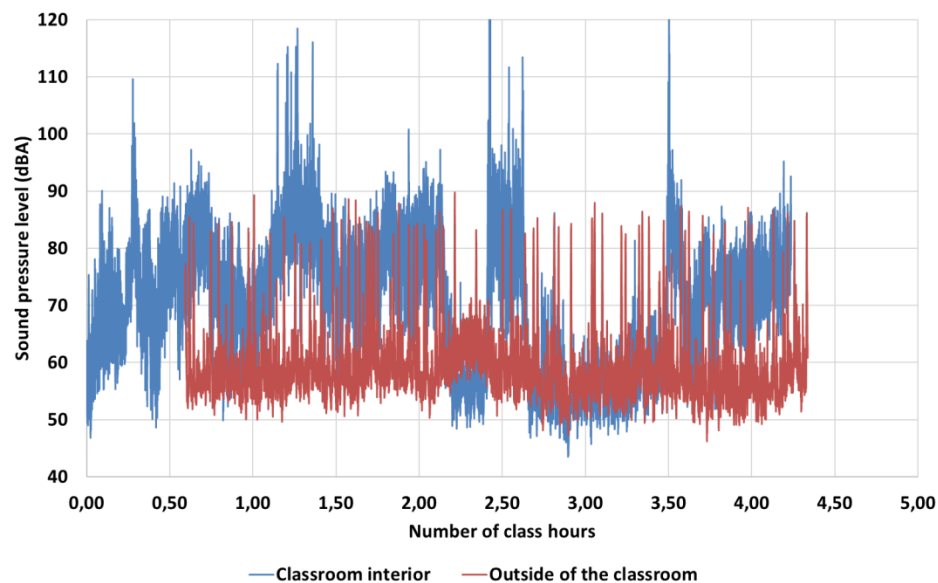
RESULTS

■ School D



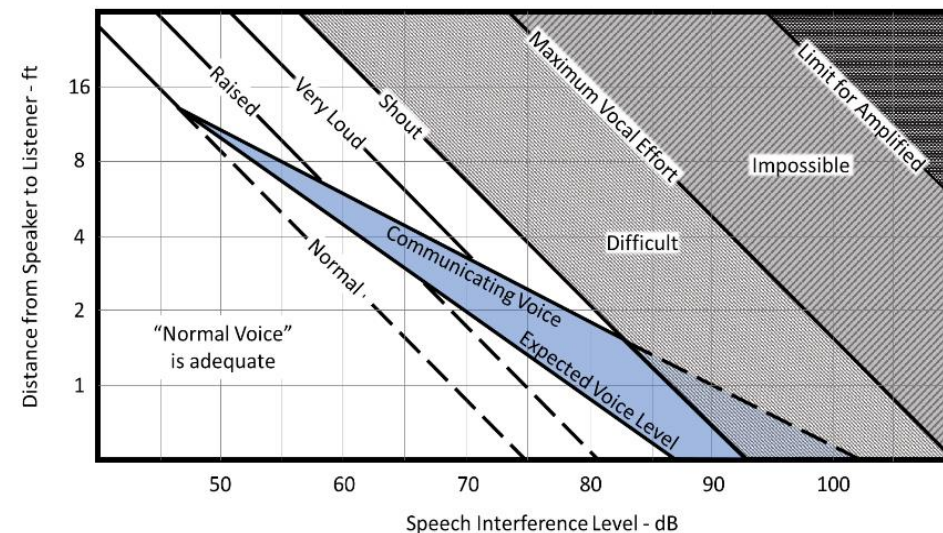
RESULTS

■ School E



RESULTS

School	L_{Aeq} Inside	L_{10}	L_{90}	$L_{10} - L_{90}$	SIL	L_{Aeq} Outside
A	79	83	60	23	85	55
B	77	82	61	21	102	59
C	72	75	49	26	81	54
D	72	85	55	30	81	59
E	88	85	55	30	86	55



CONCLUSION



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Noise levels observed in all schools were above the maximum levels established by standards NBR 10151, NBR 10152, and the WHO.

Noise levels: hinder communication, disrupt concentration and can even be affecting their health.



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Noise was predominantly generated by the students.



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Minimization of the transmission of sound from one room to another is also a matter of education, both from the individual and the collectivity.



Thank you!

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