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College students' perception of classroom noise and its consequences on learning quality

Percepção de ruído em sala de aula por estudantes universitários e suas consequências sobre a qualidade do aprendizado

Emilse Aparecida Merlin Servilha[1], Marina de Almeida Delatti[2]

ABSTRACT

Purpose: To identify the perceptions of university students about the noise in the classroom and its consequences on learning quality. **Methods:** The participants were 100 healthcare undergraduate students from ten noisy classrooms indicated by their teachers. They completed a questionnaire with open and closed questions about the presence, source, type, and valuation of noise, its impact on lessons and strategies to minimize it. The closed responses were descriptively analyzed, and compared among courses. **Results:** Mean age was 21.3 years, female predominance (85%) and unmarried (91%). The university and the classrooms were considered noisy by the students; they indicated themselves as the largest source of noise; they react to noise with an effort to listen, difficulty in concentration and irritation which interfere in learning, grades and health. In noisy conditions, the students ask for silence, to sit in front of the class or to study at home. **Conclusion:** Students identified noise as a harmful factor for the teaching-learning process, realized their role in this context and were proactive in creating an environment compatible to learning.

Keywords: Health; Noise; Noise effects; Education, Higher; Students

RESUMO

Objetivo: Identificar a percepção de alunos universitários sobre o ruído em sala de aula e suas consequências sobre a qualidade do aprendizado. **Métodos:** Participaram 100 universitários da área da saúde, de dez salas indicadas como ruidosas por seus professores. Os participantes preencheram um questionário com questões abertas e fechadas sobre presença, tipo, fonte e valoração de ruído, suas repercussões sobre a aula e estratégias para minimizá-lo. As respostas fechadas foram analisadas descritivamente e comparadas intercursos. **Resultados:** A média de idade foi de 21,3 anos, com predominância do gênero feminino (85%) e de solteiros (91%). A universidade e as salas de aula foram consideradas ruidosas pelos alunos que autoindicaram-se como a maior fonte de ruído. Informaram que reagem diante do ruído, com esforço para ouvir, dificuldade de concentração e irritação, com interferência no aprendizado, notas e saúde. **Conclusão:** Os alunos identificaram o ruído como um fator comprometedor do processo ensino-aprendizagem, perceberam seu papel nesse contexto e mostraram-se proativos na criação de um ambiente favorável ao aprendizado.

Descritores: Saúde; Ruído; Efeitos do ruído; Educação superior; Estudantes

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INTRODUCTION

Noise in elevated sound pressure levels has been indicated as a major risk factor for human health. However, a great part of the population, especially teenagers and Young adults have social and personal habits that expose them to this risk, and are not Always aware of how harmful it may be[1,2].

Some investigations have shown that excess noise is harmful to the teaching-learning process, since it is distracting, restricts attention level and cognition, and makes listening and understanding the teacher's voice more difficult for the students[3-9].

A literature review aiming to identify the relationship between noise in schools and educational activities[10] has found that noise has direct negative effects on learning, due to distraction and irritability. The sources of these noises vary from those located in the school's external environment to background noise, coming from classrooms as well as the noise generated by the students, during class activities. The authors concluded that noise is part of the causes of learning problems, that different methods are needed to solve this issue in schools and that the appropriate solution is related to the nature of the noise.

In their own particular way, each study merits in showing that the high levels of noise in schools exceed the limits proposed by Brazilian and international laws.

In Brazil, there are several laws, or norms, that aim to regulate the necessary minimum conditions for the safety and comfort of workers, and establish the noise level for acoustic comfort between 40 and 50 dB in classrooms and laboratories, when educational institutions are concerned[11]. For environments where cognitive activities, such as attention, concentration, memory and others are required, the acceptable noise level is of up to 65 dB(A)[12].

Great part of the studies that aim to measure and assess the consequences of noise in schools focuses mainly on Elementary education. This is possibly due to the fact that the children are learning how to read and write, have less control over their own attention and concentration skills because of their young age, and also because they do not have enough Independence to study by themselves; factors that make the acquisition of written communication more difficult [1,7].

In this setting, the methods when approaching noise in school include questionnaires and interviews with teachers, in addition to noise measurements. However, the studies that listen to students in this regard are rare. The student, one part of the pair involved in the teaching-learning process, has his own role and function in acquiring knowledge and should be an active element in the classroom while questioning, evaluating and suggesting changes.

One particular study aimed to find a parallel between the noise measurement values, its causes and effects on students and on the teaching-learning process. For this purpose, the authors evaluated the sound levels in areas with many students, mapped the equivalent continuous sound levels (Leq), registered the frequency spectrums in some areas, and used a questionnaire answered by the studied subjects. The findings showed that excess noise, especially coming from conversations, is one of the elements that most disturbs activities, according to 52% of the subjects. This excess generates an unruly environment, but does not harm communication or school performance. The mean sound level value was 71.7 dB (40.4 to 108.6). Regarding frequency aspects, the greatest noise levels were in frequencies between 500 and 1000 Hz, attributed to the students' voices. The authors concluded that the sound levels that were found were beyond those stipulated by the Brazilian Association of Technical Norms (ABNT), especially regarding the Leq (40 to 50 dB). Furthermore, they concluded that the students' change in attitude regarding conversations would result in great noise level changes and that an acoustic treatment of the environment would bring on improvements[13].

Regarding the university environment, a noise level evaluation in two main study environments, a study hall (a corridor with several study desks) and the Computer Institute 3 (IC-3), a small building with rooms filled with computers used by Engineering and Computer Science students at the UNICAMP campus, aimed to verify whether there is an influence in the academic performance of students[14]. In order to verify how they were affected by noise, 80 students were interviewed using an online survey for data collection. The results were that 56% of the students did not like to use the study hall and 61% disliked using the IC-3; 82% considered the study hall noisy and 42% said the same regarding the IC-3. Among the survey participants, 61% of study hall users and 50% of the IC-3 users reported believing noise in the environment is harmful to their performance.

Thus, the question that arises is whether the noise that disturbs the teacher, making him speak louder in order to be heard, and generating so many negative symptoms, especially those related to voice production, also represents a problem for students.

The creation of a favorable environment for both teaching and learning is not possible without listening to the involved parties. Teachers' evaluations on classroom noise are recurrent in literature, making it therefore necessary to listen to the other party – the student.

In this perspective, the purpose of this study was to identify the perception of students about classroom noise and its consequences on the teaching-learning process.

METHODS

The subjects of this study were 100 students of different health Science majors of the Pontíficia Universidade de Campinas (PUC-Campinas).

Ten professors, from 21 who had previously answered the Conditions of Voice Production – Teacher[15] questionnaire and had complained about noise in the university, were randomly selected and, when contacted by the authors, were asked to name a classroom they considered noisy. Ten students from each class were randomly selected to answer the study instrument.

A questionnaire composed by five closed questions from the questionnaire that had been answered by the professor was completed. These questions concerned the presence, source and intensity of noise, its attributed value (mild, medium, strong), classroom acoustics and presence of echo.

The authors created other closed and open-ended questions regarding noise interference with student behavior, with class development, with professors' voice and strategies that could minimize the problem (Appendix 1).

A pilot study was conducted with tem health Science students in order to verify whether there were any problems with question comprehension. However, response analysis did not detect these difficulties and the instrument was considered applicable to the study. The students participating in the pilot study did not partake in the following step.

After teachers were identified and the noisy classrooms were named, the authors contacted the students in the classroom, at an appropriate time in order to not interfere with academic activities.

The purposes were then presented and the students were invited to participate. Ten students among those who volunteered were randomly selected and signed two copies of the Free-Consent term, before answering the questionnaire. The researchers waited in the classroom for the completed instrument to be returned and answered the subject's questions.

The data obtained were typed and each class/major was identified by the letter C followed by a number (C1, C2, up to C10). The closed answers were analyzed descriptively and then the answers were compared among different classes/majors and among students and teachers, using Fisher's Exact Test and the t-Student Test, establishing 5% as the value of significance.

The open-ended questions received qualitative and quantitative treatment, but they will be referred to in another study, due to the volume of information that was obtained[16].

This study derives from a greater study entitled "Health and Work at the University: strategies for promoting the health of teachers", that has been approved by the Research Ethics Committee at the Pontifícia Universidade Católica de Campinas on 11/12/2009 document number 885/09.

RESULTS

The social-demographic characteristics of the studied subjects show that they are a young group with predominance of females, who are single and in their first two years of university education. There was a difference in age between the students of different majors that has distinguished them in this variable (Table 1).

The students' answers were different according to class/major, regarding the presence/absence of noise and the high occurrence they reported. However, the great majority complained about the presence of noise (Figure 1).

Regarding the student's position in the classroom, 43 (43%) were seated in the middle of the classroom, 34 (34%) up front and 23 (23%) in the back of the classroom. There was no statistical difference in the comparison between them regarding the studied variables.

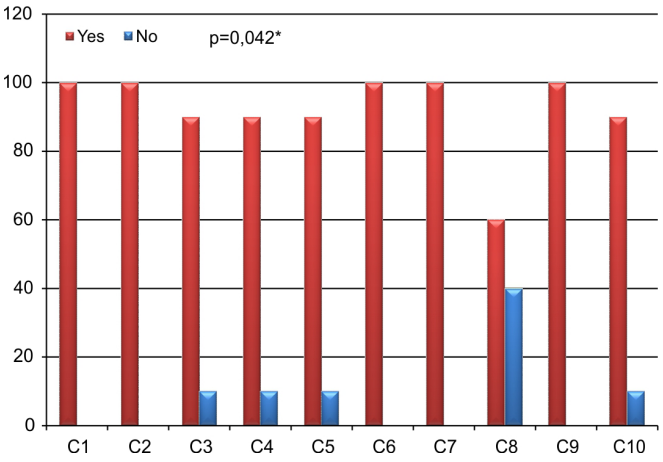
The causes of noise reported by the student varied and were related to the interior of the classroom and the university. The fact that the participants attributed the greatest cause of noise in the classroom to themselves deserves special attention (Figure 2).

The pupils stressed the varying occurrence of noise, its medium intensity and valued it as unpleasant. These characteristics were very similar among the students of different classes/majors (Table 2).

Table 1. Students' social-demographic characteristics

Course	Mean age + SD	p-value	Gender				p-value	Marital status								p-value	Semester	p-value
			Female		Male			Single		Married		Separated		Widow				
			n	%	n	%		n	%	n	%	n	%	n	%			
C1	19.0 ± 0.9		8	80	2	20		10	100	0	0	0	0	0	0		2	
C2	25.6 ± 6.3		10	100	0	0		7	70	3	30	0	0	0	0		4	
C3	19.4 ± 1.5		8	80	2	20		10	100	0	0	0	0	0	0		2	
C4	20.2 ± 1.7		7	70	3	30		10	100	0	0	0	0	0	0		4	
C5	22.6 ± 4.5	0.031*	10	100	0	0	0.052	6	60	4	40	0	0	0	0	0.001*	4	<0.001*
C6	22.7 ± 2.7		5	50	5	50		10	100	0	0	0	0	0	0		6	
C7	19.2 ± 0.9		9	90	1	10		10	100	0	0	0	0	0	0		2	
C8	20.6 ± 1.8		9	90	1	10		10	100	0	0	0	0	0	0		4	
C9	20.9 ± 1.0		9	90	1	10		10	100	0	0	0	0	0	0		6	
C10	23.4 ± 11.2		10	100	0	0		8	80	1	10	0	0	1	10		2	

*Significant Values (p≤0.05) – t-Student Test



Significant values (p≤0.05) – Fisher's exact test

Figure 1. Presence of noise in the classroom according to students

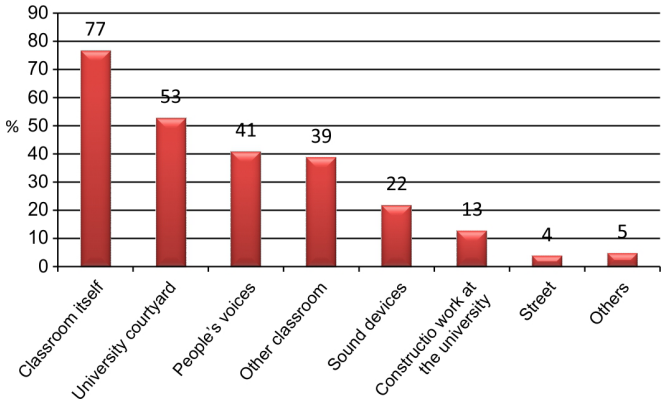


Figure 2. Noise sources reported by students

The students positively evaluated their classrooms in categories acoustics and echo, showing that they are adequate learning environments (Table 3).

Students had negative reactions when faced with noise in the classroom. The reported that noise causes discomfort, exteriorized by aggravation and lack of concentration, as well as consequences on learning (Figure 3).

Specifically regarding the students' evaluation on the interference of noise on the teaching-learning process, several difficulties were made clear, such as not understanding the teacher's voice and damage in learning and grades (Table 4).

Table 2. Noise characteristics according to student assessment

Course	Occurrence								p-value	Intensity						p-value	Unpleasant				p-value
	Never		Seldom		Sometimes		Always			Strong		Medium		Weak			No		Yes		
	n	%	n	%	n	%	n	%		n	%	n	%	n	%		n	%	n	%	
C1	0	0	1	10	5	50	4	40		1	10	7	70	2	20		4	40	6	60	
C2	0	0	0	0	6	60	4	40		1	10	9	90	0	0		9	10	9	90	
C3	0	0	1	10	6	60	2	20		0	0	9	90	1	10		9	10	9	90	
C4	0	0	1	10	5	50	4	40		0	0	9	90	1	10		8	20	8	80	
C5	0	0	1	10	3	30	6	60	0.8443	1	10	9	90	0	2	0.2211	10	0	10	100	0.0632
C6	0	0	0	0	5	50	5	50		2	20	8	80	0	2		10	0	10	100	
C7	0	0	2	20	4	40	4	40		1	10	9	90	0	2		10	0	10	100	
C8	0	0	1	10	6	60	3	30		2	20	5	50	3	30		7	30	7	70	
C9	0	0	0	0	3	30	7	70		0	0	10	100	0	2		10	0	10	100	
C10	0	0	0	0	5	50	5	50		2	20	6	60	2	20		1	10	9	90	
Total	0	0	7	7	48	48	44	44		10	10	81	81	9	9		12	12	88	88	

Fisher's Exact Test (p≤0,05)

Table 3. Classroom characteristics according to students

Course	Satisfactory acoustics				p-value	Presence of echo				p-value
	No		Yes			No		Yes		
	n	%	n	%		n	%	n	%	
C1	1	12	7	87		8	88	1	11	
C2	1	10	9	90		10	100	0	0	
C3	3	30	7	70		6	66	3	33	
C4	1	12	7	87		8	80	2	20	
C5	2	25	6	75	0.789	8	80	2	20	0.0777
C6	7	70	3	30		5	55	4	44	
C7	4	50	4	50		5	55	4	44	
C8	6	60	4	40		5	55	4	44	
C9	4	40	6	60		5	55	4	44	
C10	3	37	5	62		8	100	0	0	
Total	32	32	58	58		68	68	24	24	

Fisher's Exact Test (p≤0.05)

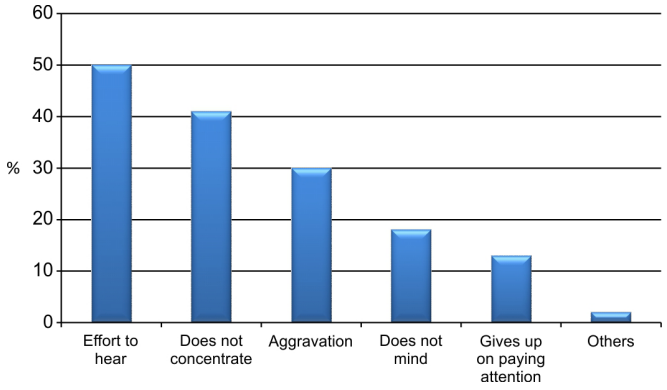


Figure 3. Students' reaction when faced with classroom noise

DISCUSSION

The high percentage of answers indicating noise in the classroom are in agreement with data from other studies that show that upper education institutions, as in Elementary Schools and High Schools have noise levels that are beyond the expected limits for an environment where teaching and learning take place[16,17] (Figure 1).

The comparison between students of different majors has shown that C8 had the greatest percentage of classroom noise complaints, which may be explained by the fact that their classrooms, differently from those of other majors, are located further away from the other buildings on campus. The high occurrence of classroom noise reports should be noted, and this noise disturbs the teacher's speech and voice, and harms its audibility for students[6,7,18]. It should be stressed that the agitation of current students is possibly not compatible with exposition-type classes, a common strategy used by teachers. This fact requires the development of new educational resources for teaching[19].

When asked to identify the source of the noise, the classroom itself was the most frequently reported, followed by the university courtyard and people's voices, reinforcing the data from other studies that show that students are aware that they are, themselves, generators of noise, harming class development, peer concentration and the audibility of the teacher's voice[10,13,20] (Figure 2). The employment of active learning methods, in which the students are involved and feel like co-builders of knowledge, may possibly result in a more effective learning and in the conservation of teachers' voices[19,21]. The relationship between type of class and noise generated by the students in the classroom requires further studies in order to broaden the understanding of this issue.

The results regarding the occurrence frequency of noise – classified by the students as sometimes present, unpleasant and of medium intensity (Table 2) – and the classroom characteristics – regarded as having satisfactory acoustics and no echo (Table 3) – are positive and are different from other studies where the classroom is frequently evaluated by teachers as having poor acoustic conditions[5,22].

The students were asked about their reaction when the classroom was noisy, and their answers revealed difficulties in hearing the teacher, in concentrating and aggravation, all inadequate conditions for information processing and, consequently, for learning[10] (Figure 3). It should be noted that the alternative presented by the pupils was to give up on paying attention, a very concerning attitude regarding university education where the student is being prepared for the work market.

When the students were asked to evaluate the interference of noise in the teaching-learning process, the majority pointed out that they were able to hear the teacher's voice, but were unable to understand, and a high percentage reported that it was

Table 4. Self-reported noise interference in the teaching-learning process by students

Course	Interferes in understanding teacher				p-value	Harmful to learning or grades				p-value	Hearing the teacher's voice well				p-value
	No		Yes			No		Yes			No		Yes		
	n	%	n	%		n	%	n	%		n	%	n	%	
C1	0	0	10	100		7	70	3	30		0	0	10	100	
C2	0	0	10	100		1	10	9	90		0	0	10	100	
C3	1	10	9	90		4	40	6	60		0	0	10	100	
C4	1	10	9	90		3	30	7	70		0	0	10	100	
C5	3	30	7	70	0.1616	3	30	7	70	0.1045	0	0	10	100	0.4645
C6	2	20	8	80		4	40	6	60		0	0	10	100	
C7	0	0	10	100		3	30	7	70		2	20	8	80	
C8	2	20	8	80		4	40	6	60		1	10	9	90	
C9	0	0	10	100		0	0	8	100		1	10	9	90	
C10	3	30	7	70		5	50	5	50		0	0	10	100	
Total	12	12	88	88		34	34	64	64		4	4	96	96	

Fisher's Exact Test (p≤0,05)

OBS: some columns do not add up to 100% since answers "I don't know" were not included in the table

harmful to their learning or to their grades[23]. Noise, due to its frequency and intensity does not allow the teacher's speech to be fully head and, as a consequence, requires the student to make an extra effort and concentrate in order to separate the teacher's voice from background noise and apprehend meaning from what is being said[8,9,14].

Students sitting at desks closer to the teacher are expected to report less complaints about hearing and understanding than those who sit at the back of the classroom[3]. However, this was not confirmed in the present study, since, when the habitual sitting places of students (up front, middle and back) were compared, there was no difference between them for the variables "interference in understanding teacher", "damage in learning or grades" and "adequately hearing the teacher's voice".

Few investigations have aimed to study the students' perspective of classroom noise, and this makes it partially impossible to compare the results of this study to those in specialized literature. More than an obstacle, this should be taken as an opportunity for conducting new studies that elect students as their subjects and consider them as a full and indispensable part of the teaching-learning process. It is also important to consider students' willingness to generate changes so that education institutions, especially universities, may become places where change is encouraged aiming towards excellence in teaching and quality of life.

CONCLUSION

Students classified the university as noisy and they considered themselves as the main source of this noise, valued as unpleasant and of medium intensity, and is considered as a harmful factor to the teaching-learning process. They realize their role in this context and they have proven to be proactive in creating a favorable learning environment.

New studies in this perspective may provide more data on the effect of noise in schools, especially in upper education.

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Appendix 1. Questionnaire about classroom noise

1. Subject identification
1. Age:_____
2. Gender: ( ) female ( ) male
3. Marital Status: ( ) single ( ) married or other form of union ( ) separated or divorced ( ) widow(er)
4. Course/Major: _____ Semester: _____
5. Date:

2. Information about the classroom
1. Is the university noisy?
( ) never ( ) seldom ( ) sometimes ( ) always ( ) I don't know
2. Is your classroom noisy?
( ) never ( ) seldom ( ) sometimes ( ) always ( ) I don't know
3. If your classroom is noisy, the noise comes from:
( ) the university courtyard ( ) the room itself ( ) other classrooms ( ) construction work at the university ( ) the street ( ) people's voices ( ) sound devices ( ) others: which ones?_____
4. How often does the noise occur?
( ) never ( ) seldom ( ) sometimes ( ) always ( ) I don't know
5. What is the intensity of the noise?
( ) Strong ( ) Medium ( ) Weak
6. Is the noise unpleasant?
( ) never ( ) seldom ( ) sometimes ( ) always ( ) I don't know
7. Is the acoustics in the classroom satisfactory?
( ) never ( ) seldom ( ) sometimes ( ) always ( ) I don't know
8. Is there an echo in the room?
( ) never ( ) seldom ( ) sometimes ( ) always ( ) I don't know

3. Noise, health and teaching-learning process
1. What is your reaction when experiencing noise in the classroom?
( ) does not mind ( ) becomes aggravated ( ) cannot concentrate ( ) has to make an effort to hear the teacher ( ) gives up on paying attention ( ) other Which one? _____
2. Does classroom noise interfere in your understanding of what is being said by the teacher?
( ) never ( ) seldom ( ) sometimes ( ) always ( ) I don't know
3. Have you ever noticed harm to your learning and your grades to to noise interference during class?
( ) never ( ) seldom ( ) sometimes ( ) always ( ) I don't know
4. In case you have, what was your attitude? _____
_____
5. Can you her your teacher's voice clearly?
( ) never ( ) seldom ( ) sometimes ( ) always ( ) I don't know
6. What is your atitude when you can't hear your teacher's voice clearly because of noise in the classroom? _____
_____
7. Where do you usually sit during class?
( ) up front ( ) middle ( ) back
8. Do you have any teachers with weak of hoarse voices?
( ) yes ( ) no
9. If your teacher's voice is **hoarse** do youo have more difficulty understanding what he/she is saying?
( ) never ( ) seldom ( ) sometimes ( ) always ( ) I don't know
10. If your teacher's voice is **weak** do you have more difficulty understanding what he/she says?
( ) never ( ) seldom ( ) sometimes ( ) always ( ) I don't know
11. What are some strategies that could reduce classroom noise and improve learning?
_____

Thank you for answering