

**inter.noise 2000**

*The 29th International Congress and Exhibition on Noise Control Engineering  
27-30 August 2000, Nice, FRANCE*

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I-INCE Classification: 6.6

## NOISE EFFECTS ON LOCAL SCHOOLS IN THE MADRID REGION

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### Keywords:

### ABSTRACT

The results of a subjective study performed on several municipalities are presented here. Opinions about noise effects in schools were asked, both to teachers and students. Questions include subjects like noise level in classrooms and their acoustic conditions, internal and external noise sources and their annoyance, as well as the causes that originate these sources. Results show that most teachers and student are concerned about noise (76.9% teachers and 58.3% students). When asked about their preferred schools location, they are inclined towards a quieter place, even being father away, than to a closer one but under the influence of urban noise (68.3% teachers and 52.2% students). Improvement in the classrooms acoustic conditions is also considered necessary by most of the teachers (70.1%) and students (60%). As for noise sources, while most important internal source is people (in the opinion of 88.4% teachers and 86.8% students), the external sources vary depending on the location, although people (41.2% teachers and 32.1% students) and vehicles (28.1% teachers and 32.1% students) can be considered the most important ones. Community Response to Noise.

### 1 - INTRODUCTION

As a part of an extensive work performed in order to elaborate at a first time the noise map of The Madrid Community, we considered, apart from experimental measurement, that knowing population opinion, as well as students' and teachers' from secondary teaching centers was essential, as their process teaching-learning could result affected.

The inquiry consisted on 20 questions for students and 24 questions for teachers, apart from some of sociological characteristics (age, sex, etc.).

In the proceeding of this task, having into account that measurements in 17 municipalities with population over 3000 inhabitants had been made, an additional study was developed in their secondary teaching centers distributed in the following way: 1°) municipalities over 100.000 inhabitants (6), 2°) municipalities between 50.000 and 100.000 inhabitants (7) and 3°) municipalities between 3.000 and 50.000 inhabitants (4).

This study included all the towns of the Community over 50.000 inhabitants, and a sampling of those between 3.000 and 50.000 inhabitants.

The number of educational centers was 50 and 2.491 inquiries were collected; 2.089 were students' and 402 teachers' inquiries.

The inquiry was divided into blocks, with questions about the noise sources, both external and internal, affecting the centers. On the other hand, questions about acoustical conditions of the classrooms and about the effect that produced noise in students and teachers were made, as well as questions about the importance given to the noise problem in their activity in the center. We also questioned about the existing sound environment and the desired environment in others rooms, such as the library.

Apart from the previous questions, which were common to both collectives, teachers were additionally asked about the effects that were produced in them by them during their labor activity.

### 2 - STATISTICAL DATA OF THE STUDIED CITIES

Taking into account that the main noise source was vehicular traffic in all the cities, we have analyzed the last years growth in every city, bearing in mind the existing statistical data and accompanying them with data corresponding to the driving park.

The previous information allowed as to know better how the transformation of the city along the time could have affected to the current existing noise environment. All data provided in this paper correspond to 1997

Figure 1 shows the equivalent noise level obtained in the different cities that have been studied.

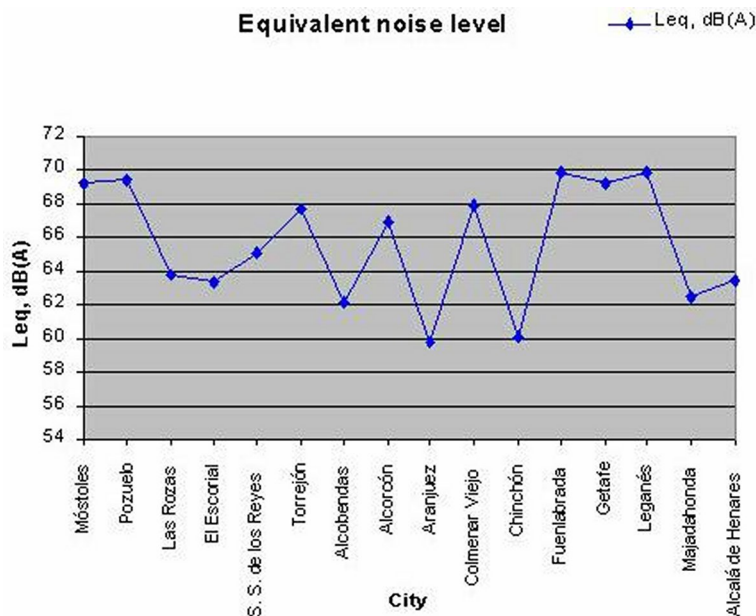


Figure 1.

### 3 - INQUIRY RESULTS

In this section, obtained results in the municipalities are shown together with the whole Community average answer in order to appreciate each answer deviation. Answers from teachers and students have been separated.

Results show opinions in relation to the institutes noise environment (classrooms and library), external and internal to the center noise sources, noise effects, etc.

### 4 - GLOBAL RESULTS

Teachers' and students' opinions in relation to the most important environmental noise subjects in the studied educational centers are shown next:

- 76,9 % of teachers and 58,3 % of students consider noise to be a concerning matter.
- The previous section result is confirmed since when asked about the criterion followed for choosing the center location, 63,8 % of teachers and 52,2 % of students would prefer the center to be quiet though far from their residence rather than a near to residence but noisy center.
- 70,1 % of teachers and 60 % of students consider classrooms acoustic conditions improvement to be necessary.
- There is a common criterion to teachers (88,4 %) and students (86,8 %) in relation to internal noise sources to be mainly people while external sources, even though depend on the municipality, are mainly people (teachers (41,2 %) and students (32,1 %)) and vehicles (teachers (28,1 %) and students (32,1 %)).
- Classrooms acoustical conditions are qualified as normal by most teachers (47 %) and students (47,3 %); the rest consider them to be deficient (the average is 25,9 % of teachers and 23,7 % of students) or good (average 23,9 % of teachers and 27,8% of students). It's observed how students answered more homogeneously than teachers (the number of inquired students is higher than teachers). Discontent about classrooms acoustical conditions outstands in Chinchón since most teachers (64,7 %) and students (59,1 %) consider them to be bad. Majority think alike in Getafe (45 % of teachers and 44,8 % of students consider classrooms conditions to be bad.); in San Sebastián de los Reyes

classrooms qualification fluctuates between regular and bad (no teachers and 17,2 % of students consider them to be good). On the contrary, both teachers and students in Majadahonda are satisfied with classrooms acoustical conditions (62 % of each case qualify them as good).

- Classrooms noise level is medium or high for most students (it is considered high by an average of 35,3 % and medium by 51,6 %). Teachers think in the same way (average percentages are 34,4 % for high noise and 44,7 % medium noise). Just 12 % of students and 16 % of teachers consider classrooms noise level to be low.

Chinchón teachers outstands again because of their negative opinion about this matter (64,7 % consider noise level to be loud). So do teachers from Torrejón de Ardoz (62,5 %) and Getafe (60%) think. Similarly to the previous question, teachers, in general, are more critical than students, with higher percentages of high noise level.

Opinions are more balanced in Majadahonda, being considered noise to be low by 33,4 % of teachers and 18,2 % of students.

- Classrooms improvement as for their acoustical conditions is necessary for most teachers (the average is 70,1 % of teachers and 60 % of students). Teachers are again more critical, considering this improvement to be necessary with higher percentages. Majadahonda outstands again over the rest of cities, since most of teachers (54,2 %) do not consider that improvement is necessary; students have more balanced opinions (43,2 % think that this improvement is necessary and 40,9 % do not).

- According to teachers, the main classrooms noise sources are internal (this is thought by 55,6 % while 44,4 % consider these sources to be external. On the other hand, most students (61,5 %) think that classroom noise is fundamentally external. This difference is basically due to the fact that students are the main noise source inside the class and they do not consider themselves to be a noise source.

Teachers from Torrejón de Ardoz (100 %) think that noise comes from outside. This opinion is shared by 88,4 % of students (we have to consider that one of the main noise sources in this municipality are airplanes, as it will be verify later). Teachers also consider the main noise sources to be external (71,4 %) in San Sebastián de los Reyes, like Aranjuez (70 %), Alcalá de Henares (55,3 %) and Chinchón (52,9 %).

- External classroom noise sources vary on the municipality. In small or quiet municipalities such as Chinchón, Aranjuez, Majadahonda and Colmenar Viejo, the most important external source is people. In bigger cities with relevant traffic densities (Leganés, Móstoles,...), external noise sources comes from cars mainly. Whether the traffic is an important noise source or not depends on the situation of the center, since it can be located near a principal communication way, road, train line, etc. Airplanes are an important noise source in Torrejón de Ardoz, Getafe y San Sebastián de los Reyes.

- The main classroom internal noise source is people, namely, students principally. This is confirmed by most of teachers (an average of 88,4 %) and students (an average of 86,8 %). This question has been answered by in a similar way by all the inquired people in the different municipalities.

As it will be observed later, noise is causer of many disturbances and most of teachers and students are concerned about it; if we consider that great part of noise comes from inside the classrooms, and concretely from people, the solution consists on adopting a more respectful and considerate behavior, educating students to be aware that solution to schools noise problems begins with them.

- Teachers, in similar percentages, suffer the different effects that noise can produce: hearing interference (83,2 %), attention and concentration disturbance (80,7 %) and it affects to the state of nerves (68,6 %). Teachers from Alcobendas and Majadahonda are the least affected by noise (no case surpasses 70 %). The other municipalities teachers suffer different noise effects to a great extend; Chinchón and Torrejón de Ardoz outstand, reaching a value of 100% affected. Environmental noise is a considerable problem in Torrejón, therefore the answer seems to be logical; on the contrary, there are no important noise sources in Chinchón, teachers designate people as the main noise source, both internal and external.

Students are also affected by noise in the classrooms, but in a lighter percentage than teachers. The most frequent effects are concentration lost (an average of 82,7%) and hearing teacher interference (an average of 78,3 %). Students in Fuenlabrada are the least affected by noise.

- Most teachers (76,9 %) and students (58,3 %) are concerned about the noise problem. The most unworried teachers are from Alcobendas (36 % of them think it's a worrying matter and 28 % do not) and from Majadahonda (50 % concerned about noise problem and 45 % do not); we must remember that in this two municipalities lower percentages of teachers were affected by noise. Students show themselves to be, in general, less concerned about noise problem than teachers. The most concerned students about this matter are from Torrejón de Ardoz (83,3 %), Chinchón (77,3 %) and Pozuelo (75,6%).
- The most annoying time corresponds to spring and summer months (as it is expressed by 91 % of teachers and 84,3 % of students). The rest is distributed between those who consider autumn and winter to be noisier (7,3 % of students and 2,5 % of teachers) and those considering all the seasons to be noisy alike (2,3% of students and 2 % of teachers).
- Had been able to choose the situation of the center, most teachers (63,8 %) would have chosen a center situated in a quiet place though they had to do a longer daily displacement. The percentage of students who would have made the same election is a bit lower (52,2 %). We verify that most teachers and students give a lot of importance to a work/study place with a quiet or little noisy environment.  
Municipalities where higher percentages of teachers would prefer a little noisy though far from residence are Majadahonda (87,5 %), Pozuelo (80 %), Leganés (73,8 %) and Fuenlabrada (71,4 %). The municipalities where most students would prefer a little noisy center rather than a near residence one are Chinchón (65,9 % surpassing the percentage of teachers thinking alike (58,8 %)), Alcorcón (55,3 %), Getafe (54,2 %) and San Sebastián de los Reyes.
- When criticizing the present noise legislation, 82,7 % of teachers think it must be harden, those who think the opposite are a minority (5 %) and the rest (12,3 %) do not know or do not answer. Students considering legislation hardening to be necessary are 52,9 % (it's a percentage quite lower than teachers), those considering it not to be necessary are 24,1 % and a similar percentage (23 %) doesn't give their opinion (do not know / do not answer).  
Therefore, we can observe that students are not very critical with the current legislation and a great percentage abstains from giving their opinion, while teachers consider that a legislation hardening is necessary.
- Nearly half of teachers (51,3 %) and students (48,3 %) think the library environment is normal. Students are more critical than teachers in this case and a higher percentage (32,2 % opposite 20 % of teachers) think that the library environment is noisy.  
Municipalities where teachers' opinion differs more from the average are Torrejón de Ardoz (62,5 % consider the environment to be noisy, and no teacher consider it to be silent) and Chinchón (52,9 % think it's noisy and 5,9 % silent). Students from Colmenar Viejo consider their library to be noisy (63,6 %, while only 1,5 % qualifies it as a silent environment). Students from Pozuelo and Majadahonda are also dissatisfied with their library (45 % and 45,5 % respectively consider it to be noisy). As for the rest of municipalities, most students affirm there is a normal or quiet environment in the library.
- The library environment is adequate for 54,8 % of teachers and 48,5 % of students. Like the question before, students are more critical with the library noise environment.  
Most teachers in Chinchón qualify again the library environment as inadequate (70,6 %). 75 % of teachers in Torrejón de Ardoz and 70,6 % Chinchón, while both options percentages are 50 % in Alcobendas and Colmenar Viejo, think that the library environment is not proper. The most dissatisfied students with their library environment are from Colmenar Viejo, where 68,2 % think it is not adequate (we must remember that 63,6 % qualified it as a noisy environment).
- All the inquired people, both teachers and students, agree that the appropriate study environment is a silent one (as it's expressed by 82,2 % of teachers and 66,7 % of students). Lower percentages prefer a musical environment (14,3 % of students and 5 % of teachers) or a little noisy one (10,3 % of students and 8,8 % of teachers).  
Teachers' and students' opinions coincide in all the municipalities where this study has been done.
- As for the library noise source, there isn't a general opinion in all the municipalities; answers are diverse. The average thinking sources are external is 41,2 % of teachers and 44,7 % of students, and those considering sources are internal are 41,5 % of teachers and 36 % of students.

The most different answers from the average appeared in Torrejón de Ardoz, where 87,5 % of teachers and 55,8 % of students consider that the library noise sources are external, in San Sebastián de los Reyes, where 87,5 % of teachers and 46,1 % of students agree and in Aranjuez (the same opinion is shared by 70 % of teachers and students). On the other hand, most students in Colmenar Viejo (77,3%) outstand thinking that the library noise sources are mainly internal.

- The most important library noise source are people since they are the main noise causers, inside and outside the library as well.  
Students in the Community share the same opinion whatever the municipality where they study. On the contrary, teachers differ more in their answers. We observe that most teachers in Torrejón de Ardoz and Getafe (62,5 % and 55 % respectively), opposed to the rest of inquired people, consider library external noise sources to be mainly vehicles (the average sharing this opinion is 20,4 %).
- There were some questions in the inquiry oriented just to teachers. One of these questions was if they considered some classrooms acoustical conditions to be better than others in their center. Most of teachers answered so (68,1 %).  
Most teachers in San Sebastián de los Reyes and Torrejón de Ardoz think that as far as acoustical conditioning is concerned there are no classes better than others (this is thought by 71,4 % and 62,5 % respectively, in comparison with a 25,6 % average).
- Teachers were also questioned about the effects that suffered because of the noisy environment in their center. The obtained answers show that most of them suffer the different effects mentioned in the inquiry. 75'4 % of teachers tend to raise their voice to mask noise and consequently 62,3 % of them suffer from throat discomfort, and 73,1 % are caused additional stress by noise.  
Lower percentages of teachers suffering noise effects appear in Móstoles since just 47,1 % need to raise their voice, 44,1 % often have throat discomfort and 38,2 % say they suffer additional stress caused by noise.

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