

**Influence of acoustics on speech intelligibility and listening difficulty in primary school classrooms. Comparison between classrooms with and without sounds absorption treatment**

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Acoustic comfort in classrooms is important for teachers and students to carry out their activities; a good speech communication leads to an increase in school performance of the students and to positive effects in terms of productivity for teachers.

The quality of speech communication can be expressed in terms of speech intelligibility, which is quantified as the percentage of a message that is understood correctly.

The aim of this thesis work is to demonstrate the negative influence on speech intelligibility of different types of noises and high reverberation time in classrooms, proving a better speech intelligibility of a classroom with an acoustic absorption treatment.

In order to demonstrate our assumption, an acoustical survey has been carried out in laboratory classrooms in two primary schools in Turin: the “Alessandro Manzoni” and the “Leone Fontana” schools. The average reverberation time measured in the laboratory classroom of Manzoni school is equal to 1,22s for the empty room and 0,85s in case of occupied conditions. In Fontana school classroom, in which a sound absorption treatment has been executed, the average reverberation time is equal to 0,6s for the empty room and 0,4s in occupied condition. The subjects of the acoustical survey are children from 7 to 10 years old which attend from second to fifth grade classroom.

The acoustical survey regarded:

- 1) the evaluation of speech intelligibility and listening difficulty by using a speech intelligibility test;
- 2) the evaluation of acoustic parameters in occupied classroom with several kind of noises (traffic, babble, fan-coil, impact noise) and reverberation times.

The acoustical survey determined the STI value (Speech Transmission Index) and the signal-to-noise ratio S/N (A).

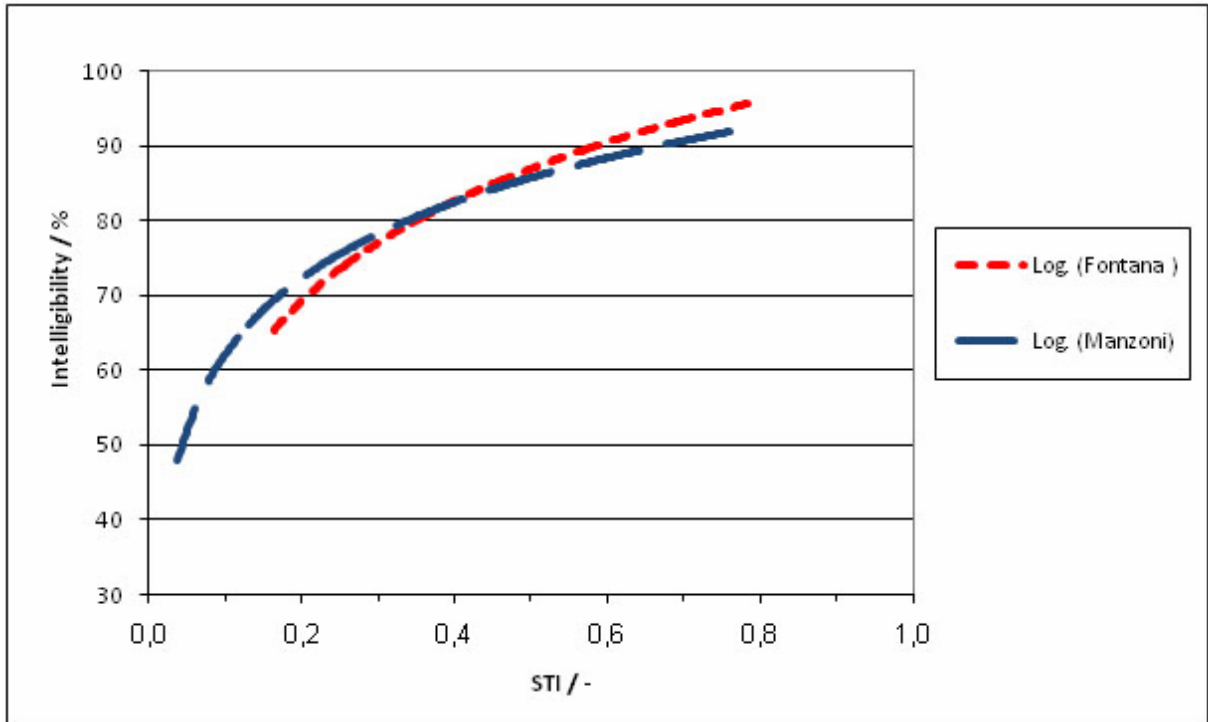


*Picture 1 – “A. Manzoni” laboratory classroom during a speech intelligibility test*

The results obtained from our experiments show that intelligibility grows up with school age; student of the second grade understood a lower percentage of words compared to children of higher grades.

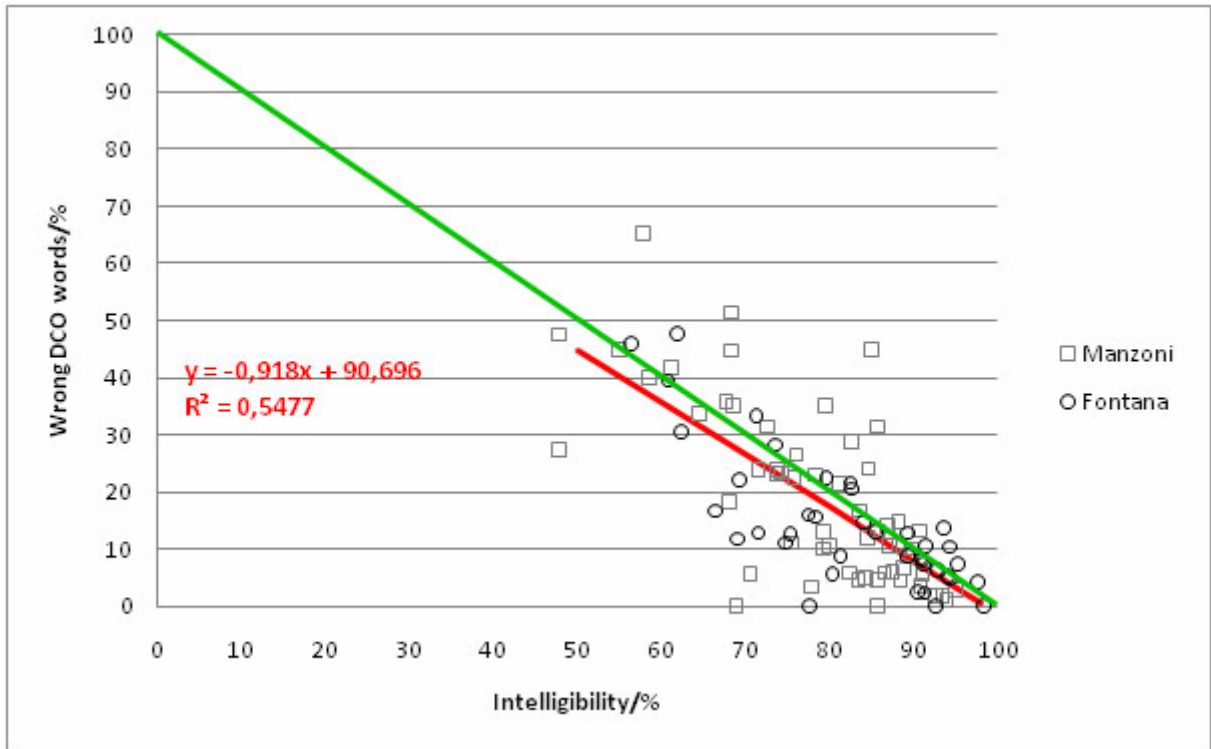
Picture n.2 shows that, for the same STI value, the “Manzoni” classroom intelligibility is lower than the “Fontana” classroom one, due to the higher reverberation time value.

Traffic and babble noises have a negative influence on intelligibility more than fan-coil and impact noises.



*Picture 2 – Mean intelligibility versus measured STI scores in presence of all types of noises, for the four grades 2,3,4 and 5, considering “Manzoni” and “Fontana” classrooms*

The last aspect considered in this thesis work is the influence of Dependent Context Orthography (DCO) words on speech intelligibility. As DCO we define the words of Italian language that haven't a one-to-one correspondence between phoneme and grapheme. The DCO words have not influence on speech intelligibility, in fact, picture n.3 shows that intelligibility does not depend on the kind of word (DCO or non-DCO), because the green regression line (all kind of words) is overlapped by the red one (only DCO words).



Picture 3 – DCO wrong words versus intelligibility considering all noises and all grade classrooms

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