

Noise Surveys for specialists

Introduction

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Please email professionals@ndcs.org.uk if you have any questions.

The problems with NOISE

Background noise refers to any undesired auditory stimuli that interferes with what a child wants, or needs to hear and understand (Crandell et al. 1995)

Excessive noise is a much more serious and widespread problem than poor room acoustics.

It may not be obvious to the teacher that the students are having increased difficulty, because adults can understand speech in noise better than younger children.

Flexer, in an article for Hearing Journal (August 2002) stated, “People can fill in the blanks of missed information only if they have that information already stored in their brain’s “data bank” from where they can retrieve it. Because they do not have those data banks, children need a sharper auditory signal than adults do. Thus, while a classroom might sound fine to an adult, it may be woefully inadequate for typical children who are neurologically undeveloped and have not had decades of language and life experience.

All this means that children require a quieter environment and a louder signal than adults do in order to learn.”

For adults to make sense of a speaker in noise they need to have the speaker’s voice (Signal) 6 dB louder than the background noise (Noise). This is a Signal to Noise (S/N) ratio of + 6dB.

Whereas a child needs + 16 db S/N ratio and a hearing impaired child needs a +20 to +30 dB S/N ratio.

A typical classroom is likely to be between +5 and -7 dB.

Flexer defines the S/N ratio as “the relationship between the primary or desired auditory signal to all the other unwanted background sounds.” She also states, “The more favourable the S/N ratio, the more intelligible the spoken message.” and “S/N ratio is the key to hearing intelligible speech.”

Bradley and Sato (2004) used the Word Intelligibility by Picture Identification (WIPI) speech discrimination test to find the optimum S/N ratio for 6, 8 and 11 year olds to achieve a 95% correct score. They evaluated a total of 878 students in 43 classrooms. Their findings were:-

Age	S/N Ratio
Grade 1 – 6 yrs old	+ 15.5 dB
Grade 3 – 8 yrs old	+12.5 dB
Grade 6 – 11 yrs old	+ 8.5 dB

The younger a child the greater the S/N ratio needed for them to understand the speaker.

Flexer also refers to the fact that we hear with the brain and the ears are only a means of getting the sound to the brain. She also states that children cannot listen like adults as their higher auditory brain centres are not fully developed until the age of a 15. Children cannot perform auditory cognitive closure like adults. (Auditory cognitive closure is the ability of the listener to ‘fill in the gaps’ of the conversation they are listening to.)

Noise and attainment

There have been many studies which used reading scores to look at the effect of noise on the attainment of students. They have mainly looked at reading scores. Bronzaft and McCarthy (1975) found that children on the quieter side of a school, next to an elevated railway, had reading scores higher than children on the side exposed to the train noise, at levels up to 89 dB(A). The train noise was later reduced inside the school by 6 to 8 dB(A) after which no difference between scores was found.

Other studies looked at the effects of aircraft noise and they came up with several different conclusions ranging from changes in teacher’s behaviour to problems with poor long term memory and reading comprehension. (Cohen et al. 1980, 1981)

Other studies looked at problems associated with traffic noise. Lukas et al. (1981) found that exposure to traffic noise had a detrimental effect on reading.

A study by Earthman and Lemasters (1998) reported three key findings:

1. Higher student achievement is associated with schools that have less external noise.
2. Outside noise causes increased student dissatisfaction
3. Excessive noise causes stress in students

Shield and Dockrell’s study came up with seven main conclusions:

1. Noise inside classrooms is not generally affected by external noise; the main source of noise is the children themselves.
2. Noise inside and outside schools has an effect upon children’s performance in standard assessment tests, the background noise in classrooms having the greater effect.
3. The SATs results of older (Key Stage 2) children are more affected by noise than those of the younger children.
4. Children in primary schools are aware of environmental noise and annoyed by the noise from other sources.
5. Noise and classroom conditions affect children’s ability to hear the teacher.

6. Classroom babble has a detrimental effect upon language based tasks.
7. Children with special educational needs are more affected by classroom noise than other children.

Noise needs to be kept to a minimum if the listener is to have any chance of understanding what is being said by a speaker especially for the primary aged students.

After conducting the 'pupil interview' and the 'preliminary survey' you may be interested in learning more about noise, if so further information about noise surveys is provided in the 'specialist' section of the toolkit.

Noise Surveys for school staff

Pupil interview

Before starting the preliminary survey it is worthwhile asking the students their opinions of the levels of noise in the school.

Shields and Dockrell's study states that, "an important first step in evaluating children's noise environments is to gain their perceptions of noises they hear and noises that annoy them." They used both interview and questionnaire techniques when consulting the students.

The questionnaire was mainly used to find the students' opinions on listening in the classroom and school in different listening situations. Their questionnaire was based on a LIFE questionnaire (Listening Inventories for Education UK Individual Hearing Profile - see appendix D) and the interviews they conducted as part of a pilot study. This study used their questionnaire with over 2000 primary pupils and it showed that young children are aware of environmental noise at home and school and find certain noise sources annoying. They also concluded that younger children generally report greater difficulty in hearing the teacher in various noise conditions and classroom situations whereas older children find it more difficult when the teacher is turned away from them.

In order to find which noise sources are both heard and annoy the students, it is suggested that an interview system is used. This means that young children can be assessed and they won't be influenced by older students giving them ideas.

The set of questions on the next page is based on the 'pupil interview' used in the Shields and Dockrell study. (The word noise isn't used in any of the questions as young students may have a different concept of noise from adults)

Pupil interview

Name Date of Interview

School

Date of Birth Age y m

Audiological status

Equipment Used

I want to talk to you about sounds that you hear at school.

The first set of questions is about sounds that come from outside the classroom.

Can you tell me some sounds you can hear from outside your classroom?

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Are there any of these sounds that you like to hear when you are listening in your classroom?

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Can you tell me why you like to hear them?

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Are there any of these sounds that you don't like to hear when you are listening in your classroom?

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.....

Can you tell me why you don't like to hear them?

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.....

What is the loudest sound you can hear coming from outside your classroom?

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Do any of these sounds annoy you and stop you hearing your teacher?

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Do you find that any of these sounds are nice to listen to and make you feel happy?

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The next set of questions are about sounds inside your classroom

Now, can you tell me some sounds you can hear from inside your classroom?

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Are there any of these sounds that you like to hear when you are listening in your classroom?

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Can you tell me why you like to hear them?

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Are there any of these sounds that you don't like to hear when you are listening in your classroom?

.....

.....

Can you tell me why you don't like to hear them?

What is the loudest sound you can hear coming from inside your classroom?

Do any of these sounds annoy you and stop you hearing your teacher?

Do you find that any of these sounds are nice to listen to and make you feel happy?

Which lessons or times of day do you find the noisiest?

Noise Surveys for school staff

Preliminary survey

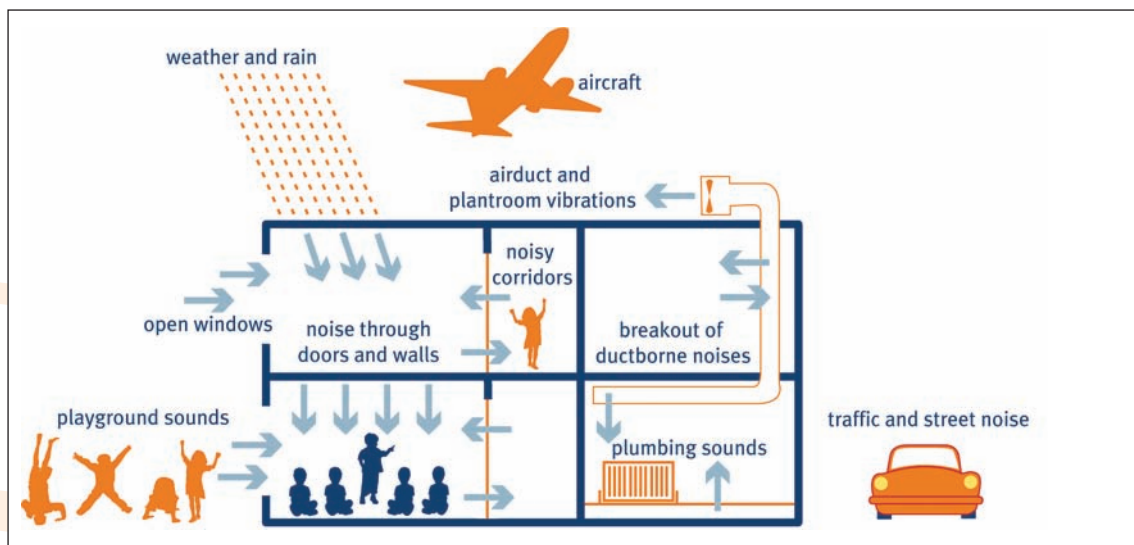
The aim of this section is to move around the school, both inside and out, and listen for noises you feel may cause the student some problems.

The only tools required for this section are pen, paper and your ears.

The 'Pupil Interview' will provide you with some indications of the more problematic noises. However, it is important that you look for other sources of noise which the student may not have noticed.

The interview will also tell you when the student feels that he or she struggles with background noise.

The picture below (from BB93) shows typical external and internal noise sources which can affect noise levels inside a school.



The four parts to the Preliminary Noise Survey are:

1. Exterior noise to the school
2. Interior noise in the classroom *school empty*
3. Interior noise in the classroom *normal working conditions, no children in the classroom*
4. Interior noise in the classroom *normal working conditions, children in the classroom.*

Conclusion

Look at your preliminary survey. Which of the survey areas shows the greatest problems with noise? There may be very simple measures that you can put in place to improve the listening conditions in your school, see the suggestions listed in the next section.

Alternatively you may decide the school needs to conduct more in depth surveys for one or all the areas in order to improve the listening conditions. You will need to employ an education audiologist, teacher of deaf children (your local authority may already employ these), acoustic consultant or acoustical engineer to look into the problem areas and make recommendations. They can use the 'Survey data collection sheets' and 'Worked examples' in section two of this toolkit.

However, a member of school staff with a keen interest in this area could loan or hire the recommended equipment and use the toolkit to undertake the noise surveys using the sections 'Survey data collection sheets' and 'Worked examples' in section two of this toolkit. They may still need support from an experienced specialist to make appropriate recommendations, especially where higher costs may be involved.

Noise Surveys for school staff

Practical suggestions for dealing with a variety of situations

Noises outside the school

- Close windows
- Place classroom as far as possible from the noise source (not next to playing field, road, building works, etc)

Noise in the school

- Close doors
- Manage the timetable effectively (not timetabling D & T or Music in the classroom next to where the deaf child's class is being taught literacy)
- Initiate rules so that classes/ pupils move quietly through school corridors during lesson times
- Re-site the classroom within the school e.g. too much noise from an upstairs classroom

Noise in the classroom

- Manage the classroom effectively
- Seat deaf child away from noise source (not next to heating/ventilation systems etc)
- Ensure regular servicing and maintenance of heating/ventilation systems etc
- Stick soft pads on the bottom of chair and table legs
- Have as many carpet areas as possible (to lessen noise from chairs)
- Use radio aid system effectively
- Use soundfield system if appropriate for room
- Use visual clues and access through text
- Turn off equipment when not being used e.g. computer/ OHP
- Provide quiet areas
- Use soft covers on display tables
- Provide INSET to staff on deaf awareness/ management of hearing loss/ equipment etc
- Provide INSET to pupils on deaf awareness