

CICS GROUP 2014 INFORMATION DAY - WORKSHOP

PRACTICAL ACOUSTIC REQUIREMENTS FOR TEACHING CHILDREN WITH COCHLEAR IMPLANTS

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We all know that acoustics have an effect on communication. Having a conversation in a room which is noisy or reverberant can be very difficult even for those of us with good hearing. If we think of “acoustics” as “listening conditions” it immediately becomes clear that any description of a room’s acoustic must include the level and type of noise in the room. Hence for the purposes of this article, “Acoustics” includes “Noise”.

For children with cochlear implants, the effects of bad acoustics on speech communication are much more severe than for most other children. Cochlear implants are designed to make speech audible to the listener without being uncomfortably loud. They deal well with the issue of audibility, but are less able to address the issues of distortion that typically accompany permanent hearing impairments. Recent developments include better use of directional microphones and algorithms to enhance speech whilst reducing background noise. However, noise remains a significant issue as it not only masks the speech signal, making it difficult to hear what is being said, but also leaves a pupil tired from the effort required to listen.

Noise comes from various sources in a classroom :

- from sources outside the building, e.g. road traffic or aircraft
- from building services in the room, e.g. heating and ventilation systems
- from equipment such as computers, projectors and whiteboards
- from adjacent teaching areas and corridors
- from teachers and pupils themselves, both as direct noise and as a result of long reverberation times.

Some of these issues can be dealt with in the design of a school. Since 2004 the Department for Education’s Building Bulletin 93 “Acoustic design of schools” has described acoustic criteria which should be met under building regulations and the school premises regulations¹. Hence schools built since 2004 should be designed to reduce noise from outside to acceptable levels, to provide a reasonable standard of sound insulation to classrooms from other parts of the building, and to reduce reverberation by the inclusion of acoustically absorbent finishes. These are, however, minimum standards for teaching children with good hearing in mainstream classrooms; even for that purpose the standards are far from ideal. These minimum standards also do not deal very well with low-frequency noise. For many children with impaired hearing, low frequency-noise can have a substantial impact on speech recognition, masking important speech sounds in a manner that cannot be

¹ A substantially revised version of BB93 has been awaiting issue in draft form for consultation for many months, but at the time of writing no date for launching the consultation had been announced. If this and the associated guidance are made available after publication of this article, the relevant links will be placed on the website www.adrianjamesacoustics.co.uk

appreciated by those with normal hearing. Unfortunately, low-frequency noise is a characteristic of road traffic, aircraft and some other sources, and is particularly difficult to control.

Building Bulletin 93 requires “Classrooms designed specifically for use by hearing-impaired students” to be designed to better standards, with lower ambient noise levels and shorter reverberation times. In theory, of course, under what was the Disability Discrimination Act and is now the Equality Act, all classrooms should be designed specifically for use by hearing-impaired students, but this has not happened, largely for reasons of cost. Another problem is that the regulations are far from universally enforced for new schools, and do not apply retrospectively to schools built before 2004. A few enlightened education authorities and head teachers have taken the initiative to improve the acoustics in their schools but this is the exception rather than the rule.

It does not follow that a school with a special hearing-impaired unit will have acoustically good classrooms. Some education authorities have spent a great deal of money building acoustically excellent HIUs where children receive speech therapy and teaching in small groups. The majority of their time may, however, be spent in mainstream classrooms which have little or no acoustic treatment and where they will struggle to make out what is being said both by the teacher and by fellow-pupils.

So how do parents find out whether the teaching environment proposed for their child is acoustically suitable? Fortunately, we have a reliable yardstick because the acoustic criteria specified in BB93 for hearing-impaired teaching are widely accepted as being a good starting point, and are very similar to those proposed by BATOD. So we might think that each school would by now have had a qualified acoustics consultant undertake an acoustic survey setting out the noise levels, sound insulation and reverberation times achieved in each room and comparing those with the standards. Sadly, this is the exception rather than the rule and even some special schools for the Deaf do not have this information (and where this has been done, the results are not always encouraging). In some schools the staff simply do not know whether acoustic data exists.

Parents can, of course, encourage a school to commission such a survey; it is not particularly expensive, and the Head teacher’s reaction to such a request is sometimes a good indication of how seriously the school takes its provision. Sometimes parents themselves have to fund measurements for SEND Tribunals. In any case, it is important to appoint a qualified, independent acoustics consultant with proven experience of such work. It is quite a complicated and technically demanding process and with the best will in the world, it is unlikely that many teachers or educational audiologists will have the necessary expertise. I have seen many authoritative-looking lists of numbers generated by school staff using expensive hired acoustic equipment; many of them, unfortunately, have proved meaningless. The Association of Noise Consultants provides a useful search facility which can help to locate independent consultants specializing in this type of work; the web page is <http://www.association-of-noise-consultants.co.uk/Member/Search>. If you think that you may need the results presented at a SEND Tribunal, you should also make sure that the measurements are taken by someone with experience of expert witness work. Recommendations from solicitors specialising in tribunal work may be useful.

Before going to the expense of commissioning measurements, however, you may be able to reach some conclusions about a given school just by observation. Visit the school on a normal teaching day and ask yourself the following questions :

1. Can you hear much noise from sources outside the classroom? If the classroom depends on opening windows for ventilation, insist on listening with the windows open as they will be on a warm day. Traffic noise is the most common culprit here, not just from busy roads but sometimes from more local sources. I recently visited a school where at the end of the day, the school's own buses waited outside for up to half an hour with their engines running. Even with windows closed, during the last lesson teachers had to raise their voices to be heard over the engine noise. It proved surprisingly difficult to persuade the drivers turn off the engines.
 2. Is there noise from heating or ventilation systems? This may not be obvious in all weathers, but some classrooms still have very noisy fan-assisted heaters. Modern mechanical ventilation systems should be reasonably quiet if well-maintained, but can generate low-frequency noise. This, and tonal noise or "hum" from lights, projectors and other equipment will probably be more distracting to a Cochlear Implanted child than to you.
 3. Can you hear noise from adjacent classrooms or corridors? If you can clearly hear what is being said in the room next door, the sound insulation is probably inadequate. Doors, glazed panels and folding partitions are all weak spots. There are a few "Open-plan" schools which can work with very specific types of teaching but they are acoustically difficult environments and are almost impossible to make work for children with hearing impairments.
 4. Does the room sound very reverberant? This is difficult to evaluate without a lot of experience, but if you clap your hands in the centre of the room and you can hear "ringing" there is a problem. This is frequently a problem in 19th century school buildings with the traditional large, high-ceilinged classrooms, but any classroom with too little acoustic treatment will exhibit some undesirable acoustic characteristics. This also has a surprisingly large impact on noise levels and behaviour during lessons.
 5. Sit in on some lessons and judge for yourself whether the pupils themselves are noisy. Of course there is always some noise during lessons but in some schools average noise levels are much higher than in others. This is a function both of class size and of discipline. If teachers regularly have to raise their voices to be heard over the noise made by the pupils, it is most unlikely that a child with a cochlear implant will cope. Classes in some mainstream schools can be alarmingly noisy; others have very clear rules and policies over noise in class and are much quieter. In general, of course, small classes tend to be much quieter, which is perhaps the main reason for the education of deaf children in independent schools. Any child with a cochlear implant will find a large class to be a very difficult environment.
 6. In schools which use "Soundfield systems" by all means listen to them but be aware of their purpose and limitations. These are, effectively, systems which use a microphone, amplifier and loudspeaker to amplify the teacher's voice, particularly for pupils furthest from the teacher. If properly installed, adjusted and used they can be useful but their main benefit is in reducing vocal effort and hence the strain on the teacher's voice. They do very little for children with Cochlear Implants and are emphatically not a substitute for good classroom acoustics.
 7. Check other areas. In some large schools, noise levels in corridors and stairwells between lessons can be alarmingly high. The same applies to dining halls and some enclosed playgrounds. As a rule, if you have to raise
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your voice to talk to someone next to you, the noise level is high enough to cause serious problems for a child with a cochlear implant.

Most importantly, try to reach conclusions based on what you hear, uninfluenced by other factors. It is all too easy to persuade yourself – or to allow someone else to persuade you – that a school that looks good also sounds good. One of the best schools that I have assessed was a large state primary school. It was a very unprepossessing 1970's building, but a great deal of intelligent thought had gone into remedial acoustic treatment of the classrooms and into teaching the children to be quiet both in class and in corridors. By contrast, I recently undertook a survey in a very expensive, brand-new, private school designed for children with all types of special educational needs including severe hearing impairment. It appeared that the architects had simply not considered acoustics at all; none of the classrooms complied even with the most basic acoustic standards. Appearances are no guide to acoustic performance.

Further resources

- An article on “*Acoustics and SEND Tribunals*” was published in BATOD (British Association of Teachers of the Deaf) Magazine in September 2013.
- “*Acoustic Requirements for Special Schools*” was written jointly by Adrian James and Educational Audiologists David Canning. It discusses in more depth some of the issues arising from BB93 and acoustics for teaching pupils with hearing impairment, as well as some other aspects of school acoustic design.
- David Canning and Adrian James also collaborated on the *Essex Study*, a research project examining the wider benefits of improved classroom acoustics..

These and other useful publications and links, are available at:

<http://www.adrianjamesacoustics.co.uk> or

http://www.association-of-noise-consultants.co.uk/Schools_Acoustics

If having difficulty locating any of this information or if looking for further information on acoustics of schools please email adrian@adrianjamesacoustics.co.uk

Biographical note

Adrian James is a Fellow of the Institute of Acoustics and a past chairman of the Association of Noise Consultants. His consultancy, Adrian James Acoustics Limited, has designed Hearing Impaired units for schools throughout England and is currently designing the new Royal Academy for Deaf Education. He was a principal author of DfES Building Bulletin 93 “Acoustic Design of Schools” and is on the working group revising that document. He also undertakes expert witness work on acoustics for SEND Tribunals.