

# Portable Sound Field Amplification (SFA) Systems - their place

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## The effects of poor classroom acoustics

The degrading effects of noise and reverberation on listening and speech and language skills in the classroom are well documented in the literature. This negative effect can be observed for all groups of children, including, of course, hearing-impaired children. Additionally there is a group of 'special' children with additional difficulties, including children with English as an alternative language, children with Attention Deficit Disorders and those with learning difficulties. Beyond all of these groups there is evidence that all young listeners are disadvantaged in poor acoustic conditions.

Where the classroom acoustic environment is poor there are two alternatives: 1) to make adjustments to the acoustic environment 2) to provide equipment that can help ameliorate the negative effects.

## Justifying altering the acoustic environment

Reverberation and background noise are the main contributors to poor acoustic conditions in schools. Background noise can be generated from within the school or classroom, or from outside. Sometimes it is possible to control the noise level by giving consideration to the use of adjacent classroom space and by reorganising timetables. Sometimes reverberation can be controlled by careful use of display boards and soft furnishings. More often, though, it is the design and fabric of the building that are the causative factors - old buildings with high ceilings and vaulted floors, open-plan classrooms leading on to common work areas, buildings with poor sound insulation or properties situated close to main roads.

The new Building Bulletin 93 (BB93) 'Acoustic Design of Schools' (2003) produced by the DfES sets a very high standard for new school buildings. BB93 gives the performance targets for compliance with requirement E4 from Part E of schedule 1 to The Building Regulations 2000. This ensures that acoustic criteria are now enforced by Building Control Officers when designers submit their plans for approval.

To alter existing buildings can be expensive, although there are many alterations that can be made which are not. Now is the time for schools to be including more ambitious solutions to poor classroom acoustics in their planning. In the context of Inclusive schooling and the SEN and Disability Act, schools must now have in place a disability

access strategy which identifies barriers to inclusion for children with SEN and sets targets to remove these barriers.

Similarly, each LEA must have a Disability Access Strategy. Funding is available to schools and authorities to implement the plans. Furthermore, Ofsted inspectors will include judgements as to how well the LEA and schools have discharged their responsibilities in this regard, when they inspect schools.

An average reception class will have approximately three children at any one time with significant glue ear. There may also be in that class children from any of the 'special' groups noted above. Bearing in mind that all children benefit from improved acoustics, targeting classroom acoustics on the accessibility plan is easily justified and should be pursued as a first-line approach.

## Providing equipment that can help

There is no real alternative to improving classroom acoustics. There are, as every Teacher of the Deaf knows, systems that can help to ameliorate the negative effects - but they all have their disadvantages. The easiest way to help any child manage in a poor acoustic environment is effectively to bring the person speaking closer to the listener - that is, within the direct field. This is the basis upon which all of today's electronic systems work.

Essentially the choice is four-fold:

- ♦ a personal FM system used in conjunction with hearing aids
- ♦ a personal FM system used with headphones
- ♦ a classroom SFA (Sound Field Amplification) system
- ♦ a personal SFA system.

None of these systems negates the need for good classroom acoustics, nor should good classroom acoustics prevent their use as the negative effects of distance remain. All Teachers of the Deaf are familiar with personal FM systems. These would continue to be the system of choice for the child with hearing aids. With such a system it is possible to attain a signal to noise ratio (S:N) of 20dB, not possible or desirable with any other system. (Flexer C, 1992). For children who have a minimal or monaural hearing loss and do not have hearing aids, a personal FM system may be used with headphones. The system selected should enable

frequency response to be contoured appropriately and for maximum output to be set - not all systems do.

### **Sound field amplification (SFA) systems**

Sound field systems have been gaining wider use in the UK in recent years. An overview of their use, both classroom and portable systems, can also be found in Section 8 of BB93. SFA systems, in general, are intended to make it easier for the child to listen and thus to learn, by comfortably raising the teacher's voice above the background noise. This may be achieved by attempting to provide an even sound field in the classroom or a S:N of +10 to +15dB.

The introduction of amplification into the classroom environment is said to bring about an increase in learning and speed of learning. It is purported to be an effective educational tool capable of bringing about significant improvements for teacher and child in the learning environment.

It is important to remember though that a SFA system will not correct poor acoustics. It will not reduce reverberation time and this may need to be addressed as a separate issue in the classroom.

Additionally, consideration needs to be given to both Health and Safety issues and classroom acoustics when SFA systems are installed and to on-going maintenance. There are considerable implications if accidents occur due to poorly or inadequately fitted systems. Systems should be fail-safe. For example, speakers should have safety chains fitted to catch the loud speaker if the bracket should fail. With regards to the acoustic aspects, there is no defined rationale for setting up a classroom SFA system. Should the aim be to provide an even sound field throughout the room? to maintain a constant S:N? to produce a combination of both? or to target specific areas within the room?

Thus, although it may be possible for the Teacher of the Deaf or Educational Audiologist to set up a SFA system, consideration should be given to whether it is sensible or desirable to do so. There is a number of companies who will provide this service and manufacturers who sell these systems will usually advise on installation and maintenance contracts.

The major advantage of using a classroom SFA system, as opposed to any of the other systems mentioned here, is that it benefits the whole class and the class teacher (in terms of reduced vocal fatigue). Thus, it can be included as part of the school's accessibility plan and monies accessed.

### **Using portable SFA systems**

Portable SFA systems can be useful for the following groups of children:

#### **1 Those children who are not able to wear conventional hearing aids but would benefit from a direct link to the teacher**

This group would include children who are troubled by background noise and effects of distance - children with a monaural hearing loss, children with a minimal hearing loss for whom noise is more of an issue than amplification and those with chronically discharging ears and fluctuating hearing losses.

#### **2 Those children who would benefit from amplification for reasons other than hearing loss**

Research has shown that specific groups of children (and adults) benefit from an improved S:N. These would include children with Learning Difficulties, Central Auditory Processing Disorders (CAPD), Attention Deficit Hyperactivity Disorder (ADHD) and those with dyslexia.

#### **3 Those children who are not able to make use of a personal FM system**

A child, for a very good clinical reason, may have a hearing aid that is not compatible with Direct Audio Input (DAI) and would therefore benefit from a personal SFA system. This may be chosen in preference to using a personal FM system with a neck loop. (The quality of these can be poor with CIC/ITE aids for example.)

The other group of children for whom a portable SFA is useful is young Cochlear Implant (CI) wearers. Although CIs can be wired to personal FM systems their use is questionable with young children, who are not able to provide information on the quality of input they are receiving. It is, of course, not possible for a parent or Teacher of the Deaf to check through the whole auditory chain with a CI and ascertain whether the system is working appropriately or not. Further, there are issues of 'balancing' and microphone priority, which are best addressed when a child is older and personal FM systems can be set up when the child is 'mapped'.

It is a very simple but important point to remember that where children are integrated into mainstream primary schools (without a unit or resource base) there is no on-site expert available at all times to check what would be a very complex and sophisticated auditory system. However, checking the function of a portable SFA system and arranging repairs is very simple.

### Setting up a portable SFA system

A portable SFA system requires very little setting up. The teacher wears the transmitting microphone and the receiver/amplifier unit is placed close to the child.

The amount of amplification available is usually limited by the microphone-speaker distance and auditory feedback as the child is often positioned very close to the teacher - for example in literacy and numeracy sessions when he or she may be seated on the floor.

Most systems will allow 10dB of gain before feedback, which is sufficient considering the speaker unit is within the direct field with respect to the child (ie on the desk in front).

Generally speaking, there is no necessity for the setting up to be technically difficult. The main criterion is that it should be 'easy' for the child to listen. (The distinction here between hearing and listening being important.) The level of sound should be comfortable and it should sound as though the teacher is actually in front of the child. That is it!

This is something we can do, as Teachers of the Deaf, which is effective, relatively easy and will make a real difference to the lives of the children in our care.

### Relative advantages

Technology	Advantage	Limitation
Personal FM systems	<ul style="list-style-type: none"> <li>♦ provide good S:N (+20dB) ie reduce effects of distance between speaker and listener</li> <li>♦ are easy to use - portable and convenient</li> <li>♦ can switch between teacher and child's own hearing aids automatically</li> </ul>	<ul style="list-style-type: none"> <li>♦ target one child only</li> <li>♦ may have frequency response or output not possible to contour or limit</li> <li>♦ can be lose benefit if child's hearing aid microphones remain live</li> <li>♦ can make children reluctant to wear them for cosmetic/stigmatising reasons</li> </ul>
Classroom SFA systems	<ul style="list-style-type: none"> <li>♦ improve S:N for all children (10-15dB) (reduces effects of distance between speaker and listen)</li> <li>♦ can provide almost an even SF throughout the classroom (no bad positions in room)</li> <li>♦ can ease strain on the teacher's voice</li> <li>♦ facilitate more natural sounding voice</li> <li>♦ permit the teacher to know if the system is working</li> </ul>	<ul style="list-style-type: none"> <li>♦ only one way - ie teacher to child - unless a microphone is passed around the class.</li> <li>♦ do not correct for poor classroom acoustics generally eg long reverberation times</li> </ul>
Personal SFA systems	<ul style="list-style-type: none"> <li>♦ are portable</li> <li>♦ improve S:N (10-15dB) - ie address the issue of distance between speaker and listener</li> <li>♦ permit the teacher to know if the system is working</li> </ul>	<ul style="list-style-type: none"> <li>♦ can be cumbersome to move around between classrooms</li> <li>♦ do not correct poor classroom acoustics in general</li> <li>♦ only help the one child</li> <li>♦ can easily 'feed back' or whistle when volume is turned up</li> </ul>