FM SYSTEMS: what are they and what do they do?

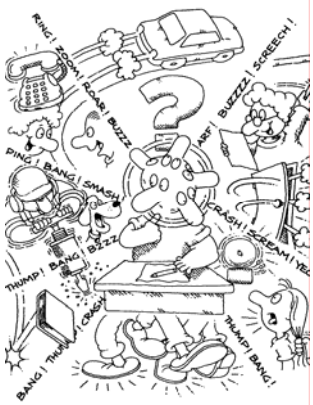
The Problem

Poor listening conditions in classrooms are common. They affect all students but cause particular difficulty for students with hearing loss. Good acoustic design and control of background noise can significantly improve the listening environment, but this is not easy to achieve and may not be enough for students with a hearing loss.

What about hearing aids?

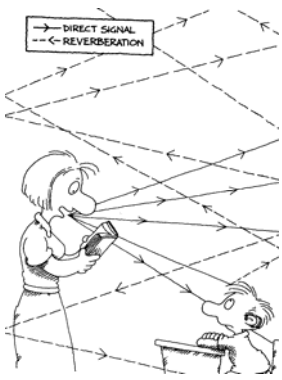
Hearing aids are usually vital to students with a hearing impairment but their benefit is limited when the sound signal reaching the hearing aid microphone is poor due to background noise, reverberation and distance.

Noise



Background noise makes it harder to understand what is being said, especially for students with a hearing loss. In classrooms, background noise is typically a combination of *external* noise (traffic, playgrounds, corridors and adjacent classrooms) and *internal* classroom noise (classroom equipment, and noise from the movement and activity of the children in the room).

Reverberation

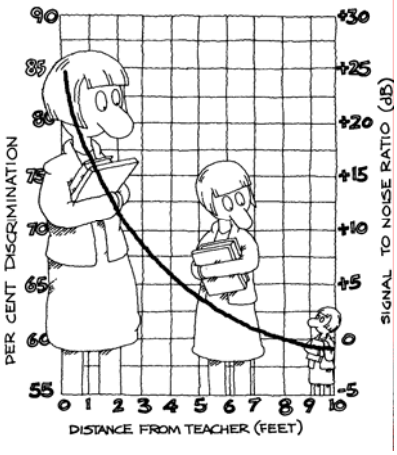


Reverberation is the reflection of sound from room surfaces. The amount of reverberation in a room depends on the room's design, construction and furnishings. Rooms with hard walls, high ceilings, bare windows and uncarpeted floors reverberate sounds considerably more than rooms with carpeted floors and soft furnishings. In rooms with high reverberation, sound bounces around the hard surfaces for longer, and this increases the background noise level.

Distance

The distance between teacher and student directly affects the level of the teacher's voice reaching the student. The further away the student is from the teacher, the softer the teacher's voice will sound.

Signal-to-Noise ratios



The signal-to-noise (SNR) ratio is the difference between the intensity of the signal and the intensity of the background noise. Noise, distance and reverberation can all decrease the SNR experienced by a student in the classroom, making it harder to understand what is said.

For a student to hear well, the teacher's voice should be about 15 to 20 decibels (dB) louder than the background noise - a SNR of 15 to 20 dB.

In a typical classroom, the level of background noise is usually about 60 dB, while the average teacher's voice measures around 70 dB at a distance of two metres. A student sitting two metres from the teacher will receive a SNR of 10 dB. This may not be enough for a student with hearing loss to hear well.

Please turn over

To improve the SNR, the teacher could try speaking in a louder voice all day long, but this is very difficult to maintain and can cause voice strain.

Reducing the level of background noise and reverberation will also improve the SNR. But, as noted earlier, this can be hard to achieve and may still not be enough for a student with hearing loss.

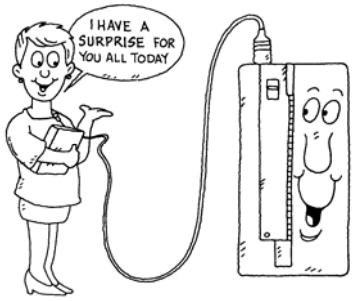
An FM system can help

FM (Frequency Modulation) technology provides the most effective means we know of meeting the challenges presented to the hearing impaired student by the classroom environment.

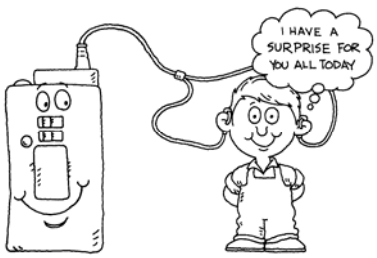
What does an FM do?

FM systems use an FM radio signal to deliver a louder and clearer signal from the teacher to the student. The FM helps overcome the effects of distance and can greatly reduce the effects of background noise and reverberation.

The teacher wears a small microphone and FM **transmitter**.



The student wears an FM **receiver** which is usually connected directly to their hearing aids. The FM transmitter relays the signal from the teacher's microphone directly to the FM receiver via radio signal.



There are a number of different makes and models of FM systems with different features and controls. The FM transmitters and receivers are small enough to allow for mobility for both teacher and student and the FM system can be connected to devices such as television, radio or cassette/CD player.

In poor listening conditions, FM systems can improve the *quality* of the sound reaching the student.

FMs and Australian Hearing

FMs are an important part of the services Australian Hearing delivers to their young clients. When deciding whether an FM system should be provided, Australian Hearing audiologists take into consideration several factors, such as educational setting, residual hearing, hearing aid use, educational and parental support and child's enthusiasm for the device. FMs are a complex and expensive piece of equipment and our desire is that young people who have an FM use it successfully and to maximum benefit.

Once fitted, Australian Hearing provides support in the area of maintenance and repairs and ongoing review of the use and appropriateness of the system.

More information

For more information about FM systems and classroom acoustics, speak to an audiologist at Australian Hearing on 13 17 97.

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