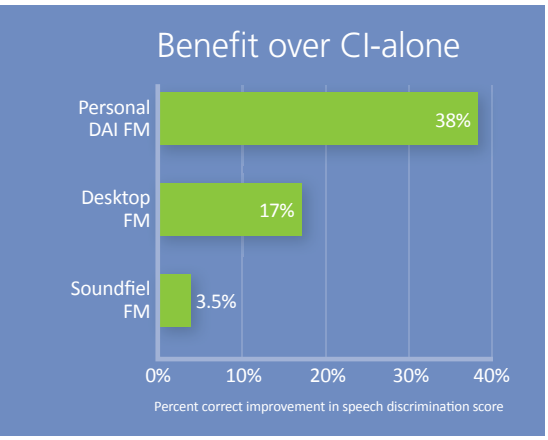
Personal FM or Soundfield amplification system?

The use of soundfield amplification systems is increasing in Australian classrooms. Many studies have shown that soundfield amplification can improve classroom listening for children with normal or near-normal hearing sensitivity[1] who do not wear hearing aids. However, available studies also show that soundfield amplification systems do not provide optimal benefit for children with hearing loss who use hearing aids or cochlear implants.

Schafer & Kleineck[2] conducted a meta-analysis of studies looking at the benefits of classroom soundfield, desktop and personal (direct audio input) FM systems for implant users. Nine studies (35 experiments) met the stringent methodological inclusion criteria for the analysis. Data for children (< 18 years) and adults (≥ 18 years) were included because previous studies had found the benefits achieved for the 2 groups are similar, and the analysis in this study confirmed that finding.

Combined result numbers (N) for the meta-analysis were:

- Soundfield amplification: (N=98)
- Desktop amplification: (N=52)
- Personal (DAI) FM: (N=228)



According to the meta-analysis findings:

- Traditional soundfield systems did not significantly improve speech recognition in noise relative to listening without an FM.
- Both Desktop FM and Personal FM did provide significant benefit.
- Personal (DAI) FM provided significantly greater improvement (38%) compared to the two other types of FM system.

Adaptive FM Advantage (Dynamic FM)

All the experiments reported in the meta-analysis above were conducted with FM receivers which give fixed FM gain – that is, the same gain regardless of noise levels in the room. Newer personal FM receivers fitted by Australian Hearing monitor noise levels in the room and adjust FM gain depending on the noise level in the classroom; this is referred to as adaptive FM advantage, or a "Dynamic" FM system. Research studies[3,4]; have shown that, for both hearing aid and cochlear implant users, personal Dynamic FM systems provide greater FM benefit in very noisy conditions than FMs providing fixed gain. Therefore, we would reasonably expect the FM advantage of a personal FM receiver with adaptive FM advantage to be even greater relative to a soundfield FM system.

What about Dynamic soundfield FM?

Dynamic soundfield FM uses the adaptive FM gain technology similar to that available in personal dynamic FM systems. An adaptive soundfield FM system monitors the noise level in the classroom and automatically increases the gain of the FM signal through the loudspeakers once noise levels in the room increase above a specified level. As yet, there are no independent studies published to compare the benefits of adaptive soundfield FM and personal FM. However the manufacturers of the only adaptive soundfield FM system on the market note that the signal-to-noise ratio (SNR) provided by a dynamic soundfield system in a quiet room will be approximately +12 dB. At noise levels between

54 and 66 dB SPL (i.e. at noise levels typical for an occupied classroom)[5], the SNR will be maintained at +10 dB, and will decrease significantly for noise levels above 66 dB SPL[6].

Is there benefit in using both personal FM and Soundfield FM in the same classroom?

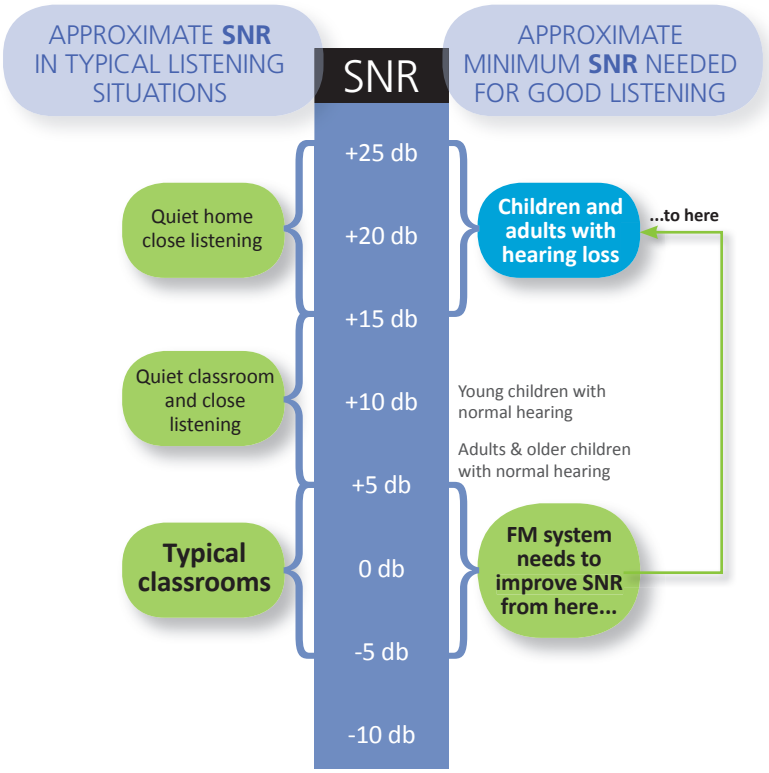
Some parents and teachers have asked if it would be beneficial to use a soundfield FM system in a child's classroom, in addition to the child's personal FM system. If a child is using a well-fitted personal FM system, there will be minimal advantage in also having a soundfield system operating in the same classroom. The soundfield system will, of course, be a potential benefit to other students in the classroom, but it will provide little if any additional benefit to a student already using a personal FM system.

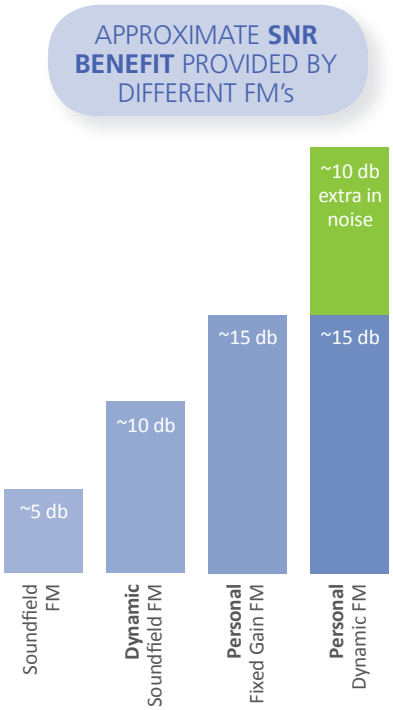
In the case of a student using a "Dynamic" personal FM system, combining a personal Dynamic FM with a Sound Field system can actually be a significant *disadvantage*. This will occur if the personal dynamic FM transmitter is connected to the audio output from a Soundfield FM base station. Coupling in this manner disables the Dynamic feature in the transmitter, resulting in an overall decrease in benefit for the personal FM user. Currently, the only way to avoid this is to use a dynamic soundfield system which uses the same model of transmitter as the personal dynamic FM system.

Summary

To optimise classroom listening, children wearing hearing aids and/or cochlear implants need to use an appropriate personal FM system. As well as providing greater benefit in the classroom, a personal FM system allows the child to use the FM system in many important out-of-school activities. This is not possible with a soundfield FM system.

Use of a Soundfield FM system in addition to a personal FM system provides minimal benefit to the user of a personal FM system and may be a significant disadvantage if the child is using a personal *dynamic* FM.





1. Millet, P. 2008 ***Sound Field Amplification Research Summary****, York University. Accessed from http://research.epicoustics.com on 30-4-2012* *2. Schafer, E & M Kleineck, 2009. Improvements in Speech Recognition Using Cochlear Implants and Three Types of FM systems: A Meta-analytic Approach.* ***Journal of Educational Audiology, 15****; 4-14.* *3. Thibodeau, L. 2010. Benefits of Adaptive FM systems on speech recognition in noise for listeners who use hearing aids.* ***American Journal of Audiology, 19,*** *36-45.* *4. Wolfe, J et al. 2009. Evaluation of speech recognition in noise with cochlear implants & dynamic FM.* ***Journal of the American Academy of Audiology, 20****; 409-421.* *5. Crandell, C & J Smaldino, 2000. Classroom Acoustics for Children With Normal Hearing and With Hearing Impairment. Language, Speech, and Hearing Services In School, 31; 362–370.* *6. "Dynamic Soundfield – the background story". Phonak. Accessed from http://www.phonakpro.com/com/b2b/en/products/more_products/soundfield/dynamic_soundfield.html on 31-3-2012.*