

Educational Considerations for Hearing Assistance Technologies (HAT)

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Students who are deaf or hard of hearing can benefit greatly from appropriately fit hearing aids and cochlear implants. However, classrooms are noisy places and children—even those with normal hearing—cannot listen in noise as well as adults due to their still-developing auditory systems. Typical classrooms have noise levels that are almost as loud as (if not louder than) the teacher’s voice. Acoustic modifications are helpful in reducing the amount of background noise and reverberation (echo) that can make listening for learning difficult, and preferential seating is helpful in reducing the speaker to listener distance. It should be noted that these modifications alone are usually not enough. It is important to remember that students who are deaf and hard of hearing need the speaker’s voice to be significantly enhanced over the noise level for maximum audibility. This may translate into better attention and greatly reduced listening effort, which often leads to optimal learning.



Signal-to-noise ratio enhancement can be accomplished using remote microphone technologies including Classroom Audio Distribution Systems (CADS; a.k.a. sound field systems) and/or personal systems. A comparison of both systems can be found in the table below:

	CADS	Personal Systems
How does it work?	Utilizes infrared, FM or digital wireless transmission to a loudspeaker or loudspeakers	FM or digital wireless transmission to student’s receiver unit directly or via direct audio input interface, telecoil coupling or via Bluetooth streamer
Advantages	<ul style="list-style-type: none"> • Benefits all children with normal hearing but should especially be considered for those with fluctuating hearing loss due to recurrent middle ear fluid, those who have learning or attention difficulties & those learning a second language. • No need to “hook-up” anything to the child • Easy to determine if there is a problem with the equipment 	<ul style="list-style-type: none"> • May be able to provide optimal signal-to-noise enhancement for children who are deaf & hard of hearing • Small & portable
Disadvantages	<ul style="list-style-type: none"> • Not able to provide adequate speech in noise enhancement for students with more than minimal hearing loss • Not easy to transport • May not be helpful if classroom acoustic environment is especially poor & can even increase noise levels (Lubman & Sutherland, 2008) 	<ul style="list-style-type: none"> • May require additional equipment (e.g. audio shoes, FM cable, etc.) to interface with the students’ devices • More complex to troubleshoot

It should be noted that if the child utilizes a hearing aid or cochlear implant, the use of personal signal enhancement technology with or without CADS is recommended over the use of CADS alone because these have been proven to provide sufficient signal-to-noise ratio enhancement to allow children to have the best auditory access in the educational setting (Anderson et al., 2005; Schafer & Kleineck, 2009; Wolfe, 2012).



Just like fitting a hearing aid or a cochlear implant, the system needs to be verified to ensure proper function and adequate benefit. For example, it is not recommended that a personal system be placed on the child's equipment right out of the box without properly fitting the device(s). Verification is usually completed by the educational audiologist using published guidelines (American Academy of Audiology, 2008 & 2011).

Regular equipment checks and listening checks are also important, especially for young children who may not be able to give feedback (Schafer & Sweeney, 2011). Hearing Assistance Technologies (HAT) add another layer of complexity in terms of hearing technology in the school. These systems will not benefit the children if they are not functioning properly. Problems that could occur include malfunctioning teacher transmitter microphones, receivers that are on the incorrect channel/network & malfunctioning audio shoes or interface cables (for attaching receivers to the hearing aid or cochlear implant).

Special Considerations for Cochlear Implant Users

Collaboration between the family, school and the implant center is very important when selecting, fitting and verifying HAT for implant recipients. Interfacing these systems to the cochlear implant is fairly complex and unlike with hearing aids, one cannot listen to how the signal interacts with the child's device output. Certain implant settings may need to be implemented and/or changed in order to maximize HAT benefit without sacrificing how the child is hearing through his or her implant microphone (Wolfe et al., 2011; Wolfe & Schafer, 2008). Also, specific frequencies may be recommended with particular devices to reduce the likelihood of interference. In addition, the receiver settings may need to be adjusted depending on whether or not the child is demonstrating expected benefit (Schafer et al., 2009).



In summary, remote microphone hearing assistance technologies should be considered for all students in order to improve acoustic accessibility so that they are able to learn in the "least restrictive environment". If you think your child or student would benefit from CADS or personal systems, please contact your educational audiologist or clinical audiologist.

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