Section V
Using Technology

Demystifying Assistive Listening Devices: The Devil is in the Detail

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Abstract

Assistive Listening Devices (ALDs) have been described by users as technology that has changed their lives, something that they would never be without again. Yet, many individuals who have a hearing loss have never used them; service providers may be unfamiliar with them as well. Personal ALDs are relatively easy to use, as long as the user is familiar with a few tips and tricks. Unfortunately, without this information, the user may think that problems that occur are due to his hearing loss and not the equipment. This paper covers basic information about the workings of the major ALD systems and provides troubleshooting tips to make ALD use a successful experience for all.

Oftentimes service providers do not understand why individuals who are hard of hearing need any accommodations in classroom settings. The student may have been able to communicate very well with the service provider on the phone or in her office. Some people believe that hearing aids and speechreading together are adequate for classroom communication. Others may think that only those with profound losses are really in need of assistance. Still others may not understand why the student seems to hear well in some situations but not others, or understands one individual and not another. This article will help the reader to understand how these seeming inconsistencies can exist and will focus on how assistive listening devices can be extremely useful in classroom settings, even for those with milder hearing losses.

Why use ALDs?

People who are hard of hearing are not just hearing speech that is softer. Because some speech sounds are softer than others, such as s, f, and th, these individuals hear softer speech with parts of words completely missing. Students who are hard of hearing depend both on what they can see (for speechreading) and what they can hear for their receptive communication. However, as they are students, they will be in many situations where much of the vocabulary is new to them. It is even more difficult to speechread unfamiliar words.

Sound is measured in frequency (high and low) and intensity (loud or soft). Hearing aids help individuals by increasing the volume in the range of frequencies in which they have trouble hearing. Unfortunately, hearing aids cannot discriminate between the sounds one wants to hear and those one does not want to hear. Classrooms and other group settings are extremely noisy situations. It is not just that the teacher may not be speaking loudly. There are 50 other students in the room moving about, tapping pencils, getting books out, and shuffling papers. The heating or air conditioning system and the fan on the overhead projector add to the noise. Although newer hearing aids with directional microphones have improved listening in noisy environments, most students will not have this technology. In addition, this technology is less effective when the person you want to hear is farther away. Hearing aids typically amplify all sounds within the prescribed frequency range within about 20 feet of the student, making hearing in noisy environments extremely difficult.

To make matters worse, acoustics are usually poor in classrooms. Research has shown that students with normal hearing can hear clearly if what they want to hear is 6 dB louder than the background noise (Signal to Noise Ratio or SNR). Students with a hearing loss need not a 6 dB SNR, but a 15-25 dB SNR to achieve the same results (Blair, 1990). Hearing aids do nothing to improve the signal to noise ratio; in fact, they can make it worse by amplifying everything.

People who have a hearing loss lose both volume and clarity of speech. Hearing aids help get the sounds one might be missing to the ear, but the individual must still spend extra effort processing what she is hearing (information coming from both the ears and the eyes). For all these reasons, a student with a hearing loss may still need assistance to achieve effective communication in the classroom.

How do ALDs help?

ALDs consist of a microphone, a transmitter and receiver system, and a coupling device, such as headphones. The instructor speaks into the microphone. The microphone is attached to a transmitter, and the transmitter sends the signal to the receiver that the student has with him at his seat. The only sounds that are being transmitted are what comes through the microphone. The student's receiver picks up the signal and sends it to the coupling device, such as headphones. There is a volume control on the receiver so that the student can turn it up or down as needed.

What do ALDs do? ALDs help minimize background noise and maximize the target sounds you want to hear. The instructor speaks into a microphone, and the student can turn up the volume. In effect, ALDs help the student to "turn down" the background noise and to focus on what they want to hear (that is, the instructor's voice). It's that simple.

Who would benefit from ALDs? People with mild to profound losses can use them. The benefit received depends on the severity of the loss. ALDs aid in speech reading in more severe losses and help reduce dependence on speechreading for milder losses. For more severe losses, ALDs may only help the individual pick up voice inflections. However, this helps the individual interpret meaning. Individuals with and without hearing aids and individuals with cochlear implants may also benefit from ALDs (those with cochlear implants would need to use the appropriate patch cords to be able to take advantage of them with the implant, or they may use the ALD with the aided ear). Finally, because ALDs help bring the target speech directly to the ear and thus help reduce auditory distractions, they may also help certain individuals with learning disabilities and attention deficit disorders. The bottom line is that educational settings are communication-intensive environments. ALDs will be extremely beneficial to individuals with a wide range of hearing loss.

Assistive Listening Device Systems

There are three major ALD transmission systems. This variety is useful, because each system has its own advantages and disadvantages. There are large area versions and small, personal versions available for each transmission system. Range varies with the system from under 100 feet to more than 500 feet. The receivers generally run off batteries, as do personal FM transmitters. With the *appropriate* coupling device, each system can be used with or without hearing aids.

FM. The personal FM transmitter is about the size of a pager and has an on/off switch and a jack for a microphone. The instructor plugs in the microphone and clips it close to her mouth, turns the transmitter on, and begins speaking. The FM receiver looks very similar and, like other receivers, has an on/off/volume control and a jack for headphones or another coupling device. The student wears the receiver, which intercepts the signals, and plugs in headphones or another coupling device to transmit the sound from the receiver to the ear.

FM uses radio waves to transmit the signal across the distance. It helps to think of the system like a radio station. The receiver and transmitter must be tuned to the same frequency to work. It provides the greatest amount of decibel output, and so it may be preferable to those with more severe losses. FM allows for a great deal of freedom of movement. In fact, you can leave the room and still pick up the signal. (Instructors should be aware that, unless they turn off their microphone, they, too, can leave the room and still be transmitting the signal.)

FM systems are susceptible to interference from other devices using FM radio waves within the same frequency range, such as pagers and

walkie talkies. Similarly, in order to be used in two rooms that are side-by-side, there must be at least one free frequency between the two transmission channels, or there may be some bleedover of the signal between the two rooms. If you pick up traffic from other devices, ask the manufacturer to recalibrate yours (or the ones causing the interference) to a different frequency. If you will be using this type of equipment in a high traffic area, purchase equipment that is narrow band or super narrowband. These transmit on different frequencies and are much less susceptible to interference from other traffic.

There are hearing aids that have a built-in FM receiver. Others can be fitted with an FM boot that fits over the bottom of a behind-the-ear aid. These will come with microphone and transmitter systems that are to be used with them.

Infrared. Infrared uses infrared light to transmit the signals, similar to remote controls and VCRs. While you must have a direct line of sight with remote controls, infrared systems have a wider area of coverage than this. Some older systems will require a more direct line of sight than the newer systems. Light does reflect off surfaces, so the signal can often be picked up from a variety of directions.

There are a variety of styles of infrared emitters; some look like panels and some look like pyramids. They are all identifiable, though, by the rows of diodes or eyes covering them. Infrared transmitters must be plugged into a power source. Most of them are plugged into an existing PA system (although there are home versions that are used with television sets).

There are also several different versions of IR receivers. All will have a light-intercepting diode on them. This diode must not be covered or the signal will be blocked. (So, unlike FM receivers, the student would not be able to put the infrared receiver in her pocket or clip it to her belt like a pager.) Some are worn like headphones and have the diode on top; others are worn like a stethoscope and the diode hangs under the chin. Still others look similar to the receivers described above for personal FM systems (except that they have a diode) and can hang around the neck or beplaced on the desk. This last type is the most versatile. Individuals who wear hearing aids often have problems wearing headphones or the stethoscope-type headsets. When you purchase receivers, make sure that a variety of coupling devices can be plugged into them (such as neckloops or headphones). Some come with the extra jack; others do not.

Because infrared light is used to transmit the signal, this system is considered secure. That is, others passing by outside with infrared receivers could not 'tune in' and pick up the signal as they could with FM. Light does not pass through walls. Infrared may be susceptible to interference from high frequency lights or direct sunlight (although indirect sunlight does not usually cause problems). Check with the manufacturer about systems that work with high intensity lighting. Infrared has the best sound reproduction across the broadest range of frequencies and is, therefore, the system of choice in theaters and concert halls. Also, many multiplex movie theaters use the system because the signals do not pass through walls and therefore, can be used in adjoining rooms.

Electromagnetic Induction Loop. This is the only system that is properly referred to as 'a loop'. The system consists of a loop of wire that is powered by an amplifier and a microphone. The amplifier must be plugged into a power source. The wire loop transmits electromagnetic waves that carry the signal, not unlike stereo or telephone speakers. An area as small as a table or as large as a room can be looped. Professionals should set up large areas, as dead spots (areas where no sound is picked up) can result.

If the user's hearing aid is fitted with a device called a telecoil, he will not need an external receiver. He would enter the looped area and flip his hearing aid to "T" to pick up the signals. Unfortunately, only about 30% of hearing aids sold in America today contain telecoils. In order for those without hearing aids (or those whose hearing aids do not have telecoils) to use the system, you should also have a supply of induction receivers on hand. These receivers look like the FM receivers described above, and headphones can be plugged into them. (These receivers are also useful to service providers in other troubleshooting situations described below.)

Unfortunately, everything that is powered by electricity gives off some electromagnetic energy that causes interference in the form of static or a hum. Some sources of interference are noticeable, while others are not. This is not the system to use in a computer lab. With some sources of interference, such as lighting ballasts, simply changing seats helps.

Application

The systems are relatively simple in concept. Application to real-life situations may require some troubleshooting. One person speaking is easy to set up, because you have only one person to mic. **What if there are questions from students in the class?** The hard of hearing student would not be able to hear the question because it was not spoken into the microphone. The teacher should repeat questions into mic, or pass the mic to the student for long comments. **What if there is not just one speaker, but, for example, a panel?** If the speakers are taking turns, you could pass the microphone to each speaker. However, if it is more of a discussion, you should have multiple microphones. People just do not reliably pass a microphone when discussions are fast paced or heated. Side comments are always lost, causing the hard of hearing student to miss out on the flavor of the interaction. Check with your audio-visual department to help with setting up multiple mics and plugging the transmitter into PA systems. Otherwise, check with manufacturers to find out about other options. The Northwest Outreach Center maintains a website that lists companies selling assistive equipment along with their websites and phone numbers. It can be found at http://www.wou.edu/nwoc/ald.htm.

What if the teacher shows a video? For the best quality use a patch cord to plug the transmitter into the auxiliary out on the TV or VCR. If this is not possible, place mic next to the television speaker. If the student is watching the video alone, the transmitter could be plugged into the headphone jack. However, this will cut the sound off for anyone not wearing the receiver and headphones. Finally, you can't speech read an off-screen narrator, so the video should still be captioned. The website listed above also lists suggestions for post-production captioning.

What if the student does not want to wear or cannot wear headphones? If the student does not have hearing aids or if he wears hearing aids but the hearing aids do not have telecoils, the student is limited to headphones or earbuds. Earbuds are single-ear versions of headphones. Some clip on; others must be held up to the ear.

If the student has hearing aids with telecoils, there are two other options. One is the neckloop: It is plugged into the receiver in the same place as the headphones (make sure your jacks are the same size by checking with the manufacturer) and is worn around the neck. It can even be worn under clothing, depending on strength of telecoil and severity of loss. As with the induction loop system, using the neckloop requires that the student flip his hearing aid to "T."

Some students may find themselves holding the neckloop closer to the hearing aid. These students may want to try using silhouettes. Silhouettes look like flattened, behind-the-ear hearing aid,s and they hook behind the ear (just like a BTE hearing aid). (They will work with either BTE or in-the-ear hearing aids that are fitted with telecoils.) Because they are closer to the hearing aid than a neckloop, they provide stronger signal for more severe losses.

Using the telecoil further reduces room noise, because you can turn off the hearing aid microphone to flip the hearing aid to telecoil. Now you only pick up what is coming across the teacher's microphone. With the hearing aid microphone off, you will not be able to hear the room noise or anything that is not said into the microphone.

Notice that the neckloop and silhouette are *coupling devices*, not methods of transmission. They can be plugged into infrared or FM receivers. Just like with the loop system, though, telecoils may pick up electromagnetic interference. Just as you would experience problems using a loop in a computer lab, you would experience problems using a neckloop in a computer lab, even though the transmission system might be FM or infrared. In both cases, you are using your telecoil, and the telecoil would pick up the interference.

Some students will not be able to wear headphones with their hearing aids because covering the hearing aid causes it to squeal or feedback. In these cases, the student will need to remove the hearing aids to wear the headphones. Alternatively, the student may want to consider having his hearing aids retrofitted with telecoils (or direct audio input) in order to take advantage of assistive listening systems.

One final note about coupling devices. Silhouettes, neckloops and headphones can be used to deliver sound to both ears instead of just one. Many people find that this greatly helps with comprehension.

What if the hard of hearing student is called on to respond? This is a problem, because on some hearing aids with telecoils, you can use the mic or the telecoil but not both at the same time. This means the student may not be able to hear

his own voice because his hearing aid mic is turned off. He is only picking up what comes into the teacher's mic. A receiver that has two jacks, one for the coupler (like the neckloop) and one for another "environmental" mic, is the answer. This mic will pick up the student's voice. This mic also allows the student to hear comments from neighbors. It also works well if the class is split into small groups. Be sure to comparison shop for these items. There can be a $150 difference in prices between catalogs on this item.

What if students are reluctant to use ALDs, even though you feel certain they would receive some benefit from them? Many times students who are unfamiliar with ALDs will be reluctant to use them. Encourage students to try out the equipment in safe environments outside of the class—for example, in a meeting with you in your office. Once they understand how helpful they can be, they will be more willing to use them. Also, explore with students to find out their fears. Provide them with the coping skills they need to gain confidence so that they can handle any problematic situations that may arise. Support groups are great places for students to get used to the idea of using ALDs and great places for students to learn more about how to live with hearing loss from others in the same situation. Self Help for Hard of Hearing Persons (SHHH) and the Association for Late Deafened Adults (ALDA) are two such groups. If there are no SHHH or ALDA groups in your area, or if the student is uncomfortable or just too busy, e-mail lists may be the perfect option. The website mentioned above includes a list of related e-mail lists and how to join them, including two excellent ones: Beyond Hearing and Say What Club.

What if the student complains of getting interference? How do you evaluate it if you do not wear hearing aids? In general, plug the headset into the receiver and see if you can hear any problems. You should be able to tell if there are any problems. If not, it may be the student's hearing aid. (In fact, some automatic room controls, such as those for heating and lighting, can cause hearing aids to hum and deplete the batteries. See Cederbaum [1996] for more information.)

If the student is using telecoils and a neckloop instead of headphones or if the room is looped, what do you do? This is where the induction receiver described above comes in handy. Plug headphones into the induction receiver, and have someone speak into the microphone of the system. You should be able to hear what the student would be hearing coming across the loop system. You might try this in rooms even if they are not looped. You can turn on the receiver, walk around, and pick up areas of static around the room. If you hear static, this may be what the student is picking up through his telecoils in using a neckloop. You may notice that some areas of the room are static free—for example, away from the light fixtures. Let the student know where the good areas are. In some cases, you may need to change rooms, transmission systems, or coupling devices.

You can also use the induction receiver and headphones check to see if a neckloop or silhouette is working properly. Just place the receiver next to the loop while it is plugged into the system. Have someone speak into the mic. You'll pick up whatever is coming across the neckloop and be able to listen to it over the headphones.

One final question people often have about students using assistive equipment is this: **Is it ever appropriate to provide ALDs and notetakers or ALDs and realtime or C-print?** The answer is absolutely. ADA requires that you look at each individual case to make a determination about appropriate accommodations. Notetaking is almost always appropriate, because you cannot take your own notes and read lips without missing something. Speechreading is still vital. Notetaking alone, though, may not be enough for *communication* access. Notes do not provide you with the information you need to be able to join in the discussion or to ask questions for clarification.

How do you, as a service provider, determine if a speech-to-print accommodation is appropriate? You cannot judge by severity of hearing loss, since speechreading skill will also be a factor. You cannot judge by how clearly a person speaks. It is not necessarily true that students with less of a hearing loss will have better speech. So, what should you be looking at? Is the course in a large room with many students? The student may not be able to sit close enough to speech read. Does the instructor have an accent or facial hair? These both make it difficult to speechread. Likewise, does the class require that the instructor is providing demonstrations and looking down, or is the instructor's speaking style such that she does not face the class much of the time? Does the

instructor speak rapidly? Is the class heavy in vocabulary, such as biology? Unfamiliar vocabulary is difficult to speech read. Is there a lot of interaction or class discussion? The student cannot use sound to locate the speaker, and therefore will not be able to follow the discussion. In any of these cases, it would be entirely appropriate to provide C-Print or Realtime support in addition to ALDs. (See the PEPNet website http://www.pepnet.org for more information about C-Print and realtime captioning.)

Tips for Success

It is very important to understand that technology does not take care of all the communication access issues. The student may still need a notetaker, because he will still be using speechreading to get the complete message. Special arrangements will need to be made if more than one person is speaking. The instructor will need to repeat questions or comments from the class into the microphone. Sometimes the only way to eliminate interference is to change rooms. Because students are still using speech reading, they may still want to avoid instructors with accents or facial hair. Give the professor and student time to practice with the equipment. Make sure the professor knows in advance and has a chance to talk with the student and be comfortable using it. Finally, it may still be appropriate to allow the student to take a reduced course load due to eye strain and auditory fatigue.

People who use ALDs often describe the impact they have had on their lives as 'life altering.' The most common reasons people do not use ALDs are that they have never used them before and/or that they do not know how to use them to get the most benefit. More information about ALDs for faculty, students, and service providers can be found on the NWOC website training module entitled "Demystifying Assistive Listening Devices." PEPNet also has a two-page Teacher Tipsheet and a full-length paper on this topic and many others. These can be found on the PEPNet website in the PEPNet Resource Center. Be sure your students know how to make the best use of this equipment to get the most out of their educations and to increase their employability.

References

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