Technology and Service Provision: Supporting Students who are Late-deafened or Hard-of-hearing through Technology

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Abstract

For students who are late-deafened or hard of hearing, accommodations in postsecondary programs often include the use of assistive listening devices such as infrared or FM systems. But this same technology can be used in foreign language interpreting, public presentations and other special events that include the general public. How, then, does an office of disability services attend to student needs, make the equipment available for other purposes, and provide maintenance and repairs? Should the responsibility fall solely on the disability services office, or are there other offices that would be more appropriate? This paper first provides basic information about common assistive listening devices, and then explores how a campus might develop an effective method of providing these services through cooperative, interdepartmental agreements.

Introduction

Many service providers in postsecondary programs come into their positions without training on the use of assistive listening devices (ALDs). In order for the student to use the ALD successfully, he or she must be able to use it correctly, and troubleshoot when problems arise. This paper will first provide a brief overview of the various ALDs so disability services providers will be able to explain their use. However, listening environments can become complicated when there are several speakers or when other electronic media are used. In these situations, it is best to have an expert to turn to for help. The second part of this paper describes how we cultivated that expertise on our campus, and offers a rationale and guidelines for developing these partnerships.

Assistive Listening Devices

How do ALDs help a person with a hearing loss? First, consider the function of hearing aids. Hearing aids are designed to amplify sound specifically to an individual's hearing loss. If an individual has a high frequency loss, those frequencies are the ones that are amplified. Usually, too, the individual's pain threshold is taken into account so that sound is not amplified to the extent that it will further damage hearing or cause pain.

Unfortunately, hearing aids are not selective about the sound sources they amplify. They amplify desired sounds, like speech, but they also amplify the hum of the air conditioner, papers rustling, and all the other noises that individuals without hearing losses are generally able to ignore.

ALDs, on the other hand, provide a direct connection between the sound source and the listener. The speaker speaks into a microphone, which is connected to a transmitter. The transmitter sends the signal to the receiver. The

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signal is then sent on to a coupling device such as headphones or a neckloop and the listener can then access those sounds (coupling devices are discussed in more detail below). Only sounds coming through the microphone are transmitted through the system. By using ALDs, the speaker can be at a distance, but the sound will be delivered directly to the individual, as if the speaker were standing next to the listener. However, ALDs amplify all frequencies at the same level, much like turning up the volume on the TV. By using ALDs with hearing aids, the target sound is delivered to the individual without all the environmental noise, *and* the various frequencies are amplified according to the individual's needs.

The success of ALDs often falls on two factors. First, microphones vary in quality and function. Some microphones are unidirectional, picking up only those sounds coming in from one direction; others are omnidirectional and will pick up sounds from any direction around the microphone. Quality and function should be taken into consideration when purchasing microphones for ALDs.

Second, the same tips one uses in addressing a hearing impaired person without an ALD apply when an ALD is used. These tips include facing the individual for optimal lipreading, not standing in front of a window or bright light (including overhead projectors), allowing time to view visuals before beginning discussion of them, and repeating questions from the audience into the microphone.

FM. Probably the best-known system is FM, which stands for Frequency Modulated. The system is made up of a transmitter, which can be thought of as a small radio station, and a portable receiver, comparable to an FM radio. The system transmits sound using FM radio signals.

Like a radio station, the user can tune in various channels, so the transmitter and the receiver must be set to the same station. Radio waves do transmit through walls, therefore this is not a secure system. If two systems are being used in close proximity, there should be at least one channel difference between the two systems to avoid spillover of the signals. Also, speakers should be reminded to turn off their microphone/transmitters before they leave the room and/or hold private conversations.

There are several advantages to using FM. FM systems are very portable. They can be used indoors or outdoors. They are very easy to set up, operate, and use. And they may be the better system for students with a more severe hearing loss, because they have a greater acoustic output than infrared.

With these systems, however, each listener must have a receiver. Another disadvantage is that the quality varies with the manufacturer. But the biggest problem with FM is that there is a potential for outside interference. Although 72-76 MHz bandwidth has been set aside by the FCC for use in FM systems, outside interference may occur with nearby radio stations, pagers, police band, and construction walkie talkies.

Infrared. Infrared systems use infrared light to transmit the signal in much the same way remote controls transmit signals to TVs and VCRs. Suppose as you are trying to fast-forward a tape, somebody walks between you and the VCR. The signal will be interrupted, and the VCR will stop fast-forwarding. The same is true of the infrared ALDs, in that a direct line of sight must be maintained between the transmitter and the receiver.

Infrared systems consist of an LED emitter panel as the transmitter and a receiver with a photo detector diode. The signal is sent out in 60 degree cone of light. Infrared systems may be set up in a variety of ways. The emitter diodes of the transmitter for large room settings might be in ceiling panels or mounted high on the wall. (Obviously when setting up an infrared system in a large room, an expert should be consulted.) The receivers would have diodes located in a way to ensure direct line of sight, such as on the top of headphones. There are some receivers that can be placed on desktops and have coupling devices plugged into them, but again, direct line of sight must be maintained.

There are several advantages to infrared. Because it is using light, it does not transmit through solid objects. This means two infrared systems can be set up in rooms next to each other, and there will be no spillover or

interference between the two rooms. It also means that it will not transmit outside of the room. This can be very important when using ALDs in jury rooms, or in meetings where security is vital. Another advantage is that the receivers are compatible with most transmitters. This means that you can use your personal receiver from your home system with the infrared system in the movie theater or the classroom. Finally, infrared has the widest bandwidth of any of the ALDs, providing the best sound reproduction. It is the system of choice for music listening.

There are also several disadvantages to infrared. Because infrared ALDs are using light, they cannot be used in bright light or outside on sunny days. Bright light washes out or interferes with the signal transmission. Fluorescent and high intensity lights can also cause interference. Receivers are needed for each person. Receivers for personal FM systems are often headphones, which students may feel draws too much attention to them in the classroom. The direct line of sight requirement limits the flexibility of movement while using the system. Large emitter panels require electrical power instead of battery. Finally, the quality of the emitter panel varies with the manufacturer.

Electromagnetic induction loop. The induction loop transmitter is actually several loops of wire. It is very versatile in that many settings can be looped: classrooms, the dining room table, sofa, or car. This system is slightly different than the other two described in that the T-coil (described below) in the hearing aid is the receiver. If the user has a hearing aid with a T-coil, all he or she has to do to access the system is switch the hearing aid to T. Because there is no coupling device involved, it is the least obtrusive of all the systems. If the user does not have a T-coil, an external receiver can be used that is coupled to headphones.

This system transmits the signals by electromagnetic fields, like power lines, telephones, computer monitors, and fluorescent lights. Because they each create electromagnetic fields, these can each cause interference with loop systems. Likewise, adjacent rooms cannot be looped unless the loops are shielded to prevent interference.

The main advantage to induction loops is their ease of use with T-coil hearing aids. Once the loops are installed, they are very durable. Some are portable so you can move them around. The disadvantages are that portable ones may present a mobility hazard, and permanent installation can be expensive. Finally in large areas that are looped, there may be dead spots toward the middle of the looped area. The farther away the user is from the energy, the weaker the signal is. Distance makes a difference.

From Signal to Sound

Coupling devices. A coupling device is used to get the signal from the receiver to the ear or hearing aid and is *separate* from the assistive listening system. It might be a set of headphones, earbuds, a neckloop, or a single or double silhouette. In theory, the coupling devices are interchangeable among the different systems (with the exception of the infrared headphones that have the receiver diodes built in). In reality, the plugs that attach the coupling devices to the ALD receivers are not standardized, and thus may not fit ALDs made by other manufacturers.

ALDs may be used with or without hearing aids *if* the appropriate coupling device is available (and depending upon the individual's hearing loss, of course). Examples of couplers that can be used with or without hearing aids are those that have speakers, such as headphones or earbuds. The disadvantage of the user not having a hearing aid is that it lacks the fine tuning to the individual hearing loss. Nonetheless, for some individuals with a mild loss, using headphones with an ALD will provide the boost in sound that they need to increase comprehension.

Telecoils. Some coupling devices can *only* be used with hearing aids equipped with T-coils.[2] These devices, such as neckloops and silhouettes, are not conducting sound, but an electromagnetic field, just like the induction loop

[2]The reader should be aware that newer hearing aids may have direct audio input or built in FM receivers, and that ALDs can also be used with these aids. These variations have not been covered here.

described above. Briefly, the alternating current of an audio signal creates an electromagnetic field that radiates away from the wire. When two wires are close, the electromagnetic field of one will induce a current in the other wire. The T-coil in a hearing aid is actually a small electromagnetic induction coil, i.e., a wire. (Note: no matter what type of ALD is being used, the coupling device is receiving an audio signal that creates an electromagnetic field. The coupling device may convert the signal to sound, as in the case of headphones, or, as with neckloops and silhouettes, it may simply provide a way of getting the wire of the coupler close to the wire (the T-coil) in the hearing aid, and then the hearing aid will convert the electromagnetic field to sound.)

In hearing aids with T-coils, the user can choose to have sound input coming through the hearing aid microphone *or* to have the input coming through the T-coils. This is usually accomplished by flipping a switch from mic to T. In everyday use, the switch is on mic. This means the hearing aid is amplifying all sounds coming in from the environment. When the switch is on T, the only sounds a person will pick up are those that are being conveyed through the T-coil. Note that this also means that unless the hearing aid user is speaking into a microphone connected to the ALD system, he or she may not be able to hear and monitor his or her own voice. Although some newer hearing aids have the option of having both the mic and the T-coil in use at the same time, for most aids switching to T means turning off the environmental microphone.

The most common use of the T-coil is its use with the telephone, and it provides a vivid illustration of the difference between the mic and the T-coil on a hearing aid. Telephone speakers (as well as other speakers) contain induction coils. If an individual is using the telephone with the hearing aid on mic, he or she would put the earpiece over the ear to hear. If, on the other hand, the individual is using the T-coil, he or she would place the earpiece of the phone over the hearing aid to bring the two wires to the closest proximity. If the individual is wearing a body-type aid, the earpiece of the phone may not be placed anywhere near the ear. The same also applies to headphones. Without T-coils, the headphones would be placed over the ears; with T-coils, they would be placed over the hearing aids.

So far, we have described only simplest set ups. However, these systems can be much more complicated: there may be more than one user on the system, multiple speakers, or a variety of sound sources, such as films or audiotape. Rather than add electronics expert to the many hats disability services providers must wear, the remainder of this paper discusses options postsecondary programs have for dividing responsibilities and cultivating experts.

Service Delivery

Disability Services (DS) offices perform many functions on campuses. DS providers must be knowledgeable about a wide variety disability needs and accommodations, determine the appropriate classroom accommodations for students with disabilities, educate faculty and other students in disability awareness, encourage students with disabilities to advocate for themselves, and in some cases, also accommodate employees with disabilities.

Campus and classroom environments are becoming much more complicated, as well. Class materials are no longer limited to pencil and paper, or audio/visual materials. They now include computer programs, the internet and the world wide web. Classes may not even be physically on campus. More and more, colleges are supporting distance learning, satellite and video conferencing, and internet classes. In addition, there are many events sponsored by the campus, such as theatrical productions, political debates, and graduation ceremonies that must also be accessible. Because DS is the gateway to classroom accommodation, providers may automatically take on (or be expected to take on) the responsibility of making the entire campus accessible. While the goal is to have an accessible campus, is it desirable and/or feasible for *all* of the responsibility fall on the DS provider?

Philosophy. Two beliefs drive our policy decisions: 1) the entire campus is responsible for all of the students on the campus, and 2) the entire campus should be accessible to all students. All too often, if a student with a disability

has a problem on campus, whether it is a problem with a class or financial aid, the student is sent to the DS provider for help. But, if a student has problems in an English class, he or she should go to the instructor, or possibly the tutoring center. If the student were a football player, the process would be the same; he would not be sent to his coach for this help. Similarly, a student who is hard of hearing should not be sent to DS. Too often, when DS services provides all of the accommodations, they are also the only ones on campus *thinking* about accommodations. By developing policies with these two beliefs in mind, we are accomplishing our goal of encouraging departments to think of students with disabilities as part of *their* responsibility, and not just the responsibility of DS.

Models for providing accommodations. There are several accommodations that might be provided to students who are hard-of-hearing or late-deafened. These include notetakers, interpreters, realtime captioning, alternative testing, captioning, and of course, assistive listening devices. In addition, there are a variety of environments and settings that need to be accessible: classrooms; meetings that take place in a professor's office; a club meeting or activities; group and one-on-one tutoring; student activities like ball games, concerts, or plays on campus; public events sponsored by the campus such as graduation; counseling sessions; and distance learning.

Disability Services might be the logical appropriate provider in some of these situations, such as negotiating in-class accommodations with an instructor. In some cases, though, an option might be that DS would approve the student for certain accommodations, and then let other departments carry them out on an as-needed basis. For example, instructors with hard of hearing students in their classes would be responsible for making sound clips on their web pages accessible to their students by offering a printed description of the audio clip. Or the computer lab housing the Dragon Dictate program could check with DS to ensure that the student has a disability before they allow him or her to use the program.

A third option is to make the point of entry of the person with a disability responsible for providing accommodations independent of DS. For example, several ALDs may be kept in the campus theater box office so that anyone attending a performance can request one when necessary. Computer programs that are useful for students with disabilities might also be useful for students with no documented disabilities. The programs could be available to all students with no documentation required.

Advantages. There are several advantages to developing a shared responsibility on a campus in providing services to students, faculty and staff with disabilities. The first of these is simply logistics. Most DS offices close at 5:00 p.m. What happens if an unexpected need arises after hours? Campus security is open 24 hours. The library is open late, as are Health Services and computer labs. Theater productions are typically scheduled for evenings and weekends. By making ALDs and TTYs available in offices that are open after regular office hours, the campus will be accessible on a 24-hour basis.

A valuable lesson for us has been learning that departments, with their expertise in various areas, are able to apply their knowledge to accessibility with little training. DS providers, on the other hand, cannot become experts in financial aid, technology, specialized computer programs, or multimedia presentations without burning out very quickly. Other departments have already developed that expertise and, with assistance, can apply that expertise to serve students with disabilities.

As an example, on our campus, DS provides personal ALDs to students for use with class lectures. However, these ALDs will probably not be adequate to provide access for classes that are group discussions. No one in the DS office is skilled in setting up microphones for large areas. By providing training to the department on campus that typically sets up electronic equipment (for example, Educational Media), we can call and request that the room be set up instead of trying to figure it out on our own. On our campus, we set up a three-hour workshop for the Educational Media personnel (inviting their counterparts from other campuses as well) on setting up, maintaining, and

troubleshooting ALDs. Since this training, they are much more confident and able to set up rooms appropriately, and as DS providers, we can spend our time working on other issues.

Captioned videos and accessible software are also examples where responsibilities can be delegated. ADA requires that all new materials must be accessible, and that accessible materials must be purchased if there is a choice between an accessible item and one that is not. Make sure each department ordering these materials is aware of the ADA regulations and that they order captioned materials. In this way, each department becomes more aware of the issues, and becomes an educated consumer and advocate when ordering and making requests for accessible materials.

Finally, it is very common for departments to develop great ideas for projects, activities, and outreach, and to not think about how to make them accessible unless someone requests it. By encouraging departments to be responsible on a daily basis, they are more likely to incorporate accessibility issues into their brainstorming of new projects. When they begin to take on the responsibility themselves, they develop a vested interest in the process, and they begin to shift their thoughts about accessibility from equipment to students – *their* students.

Avoiding pitfalls. How do you avoid pitfalls in establishing partnerships? Policies should be established that spell out who is responsible for the purchasing and upkeep of the equipment, whether or not documentation is required for use of the equipment, and where the equipment will be housed. For example, we provided some ALDs to the library, box office, and campus security. However, they will purchase new equipment as needed.

In addition to policies, responsibilities concerning disability access should be built into job descriptions. In our Educational Media department, setting up assistive listening equipment is listed in the job description. When new employees are hired into these positions, it is clear that this is one of their responsibilities. In our computing labs, workers there are expected to be able to use the specialized software programs, such as Dragon Dictate, so that they can provide help to any student that comes in. Having the responsibilities built into the job descriptions helps establish responsibilities into standard operating procedures. It helps to guarantee that a department is taking on the responsibility for accessibility. In addition, we can feel confident referring technical questions to the appropriate person.

Finally, training must be provided to ensure that the partnerships are successful. Personnel must be provided the appropriate tools in order to successfully provide access. For example, in order for our Educational Media department to be able to go that extra step to check that the ALD systems they set up are working, they must have a hearing aid to test out the system. Otherwise, they would set up the equipment and assume everything is in working order. By the time the student finds out it is not working, it is too late to remedy the matter and the student misses out. In order to avoid these situations, Educational Media needed a hearing aid with a working T-coil to test the room set ups. Used hearing aids can be obtained from various organizations, such as the Lion's Club or local audiologists.

Summary

Although many responsibilities are appropriately those of DS providers, all too often providers find themselves taking on responsibilities that could be better provided by other departments. Building partnerships between departments builds relationships to the benefit of all, DS providers, students with disabilities, and the other departments. It increases the awareness of accessibility needs in other departments, and increases their confidence and ability to make those accommodations.

Resources

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