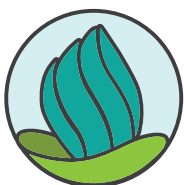
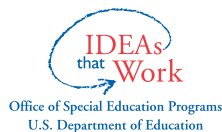


Assistive Listening Systems 101



NDC
National Deaf Center
on Postsecondary Outcomes



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Assistive Listening Systems 101

Overview

Personal amplification devices such as hearing aids, cochlear implants, and bone anchored hearing aids (BAHA) work to make sounds more audible for deaf¹ individuals with residual hearing. Residual hearing is the ability to experience some sounds, such as a certain frequency or volume, even with hearing loss. Personal amplification devices support deaf individuals in a variety of ways. For example, some individuals can use these devices to communicate on the phone or hear environmental sounds better. However, it is important to note that not everyone will experience the same benefit and not everyone uses personal amplification devices. Relying on amplification devices or residual hearing alone may not be enough to access communication, especially in difficult listening situations (e.g., significant background noise, a room that is not designed for ideal acoustics, group discussions, or listening at a distance). Assistive listening systems can offer further support in these situations.

What are assistive listening systems?

Assistive listening systems² are designed to enhance the understanding of speech for deaf individuals. Factors that can degrade the speech signal and impact one's ability to understand speech include distance from the speaker and room acoustics. Background noise like side conversations and even heating system fans can also degrade the speech signal, especially for people with personal amplification devices (hearing aids, cochlear implants, or bone conductor/BAHA aids).

Assistive listening systems reduce these challenges by using a remote microphone to pick up sound and broadcast it across the room to a receiver worn by a deaf individual. Traditional receivers use listening options to deliver the sound from the receiver to the user's ear or personal amplification device. Wireless receivers connect directly to some personal amplification devices.

1 NDC uses the term *deaf* in an all-inclusive manner to include people who identify as deaf, deafblind, deafdisabled, hard of hearing, late-deafened, and hearing impaired.

2 *Assistive listening systems* is the term commonly used in the Americans with Disabilities Act. They also have commonly been referred to as hearing assistive/assistance technology (HATS), assistive listening devices (ALDs), assistive technology, and other similar terms.

KEY POINTS SUMMARY

- Assistive listening systems provide communication access using different broadcasting processes. Providing 'effective' communication access for a deaf individual is driven by the personal hearing system they have, whether it is hearing aids, cochlear implants or BAHAs.
- An assistive listening system should be chosen based on room size, configuration, or student need. The challenge is to find the most appropriate listening option or connection coupler to provide the cleanest sound signal possible to meet the deaf individual's needs.
- Assistive device manufacturers, audiologists, other disability support options and the individual's own past experiences with technology can help secure the most effective system.

Responsibility for Equipment

INSTITUTIONAL RESPONSIBILITY

Institutions are required to provide assistive listening systems as an auxiliary aid for effective communication access. A basic system includes a transmitter with a microphone (either portable or connected to a sound system) and a receiver. There are two types of receivers; one is a traditional receiver that delivers sound via a listening option using headphones or neckloops, and the other is a wireless receiver that connects directly to the user's hearing aid or cochlear implant.



Listening options are usually purchased with the assistive listening system. Headphones are usually used by individuals who do not wear hearing aids. Neckloops are for users who have a telecoil (also known as T-coil) in their hearing aid or cochlear implant. If the T-coil can be used, no other part is needed.

Wireless receivers connect directly to some hearing aids or cochlear implants. A different listening option is needed with wireless receivers and cannot be purchased with the assistive listening system. These components need to be ordered separately.

STUDENT RESPONSIBILITY

Personal amplification devices are often the student's responsibility. Any student who has a hearing aid or cochlear implant with a T-coil can use the assistive listening system (with neckloop) provided by the institution. There are two situations that may require additional components to connect to the assistive listening system that has been provided by the institution.



If the hearing aid style or cochlear implant can accept a wireless receiver (provided by the institution), then a coupler (also called an "audio boot") is needed to connect the wireless receiver universal plug to that specific hearing aid or cochlear implant. If the style of the hearing aid or cochlear implant does not allow for direct connection, then a streaming device may be needed to provide that connection.

ONE SIZE DOES NOT FIT ALL

- The coupler that is purchased for one student may not be compatible for the next student. There are multiple hearing aid and cochlear implant manufacturers and each brand has proprietary components that are not interchangeable across brands. The coupler is usually purchased through an audiologist.
- While these couplers are not universal for all students, they are still a necessary component to provide an effective connection to the assistive listening system.

Large Venue/Seating Area: What Does the Law Require?

In the Americans with Disabilities Act (ADA), colleges and universities will find the following guidance regarding assistive listening systems. First, Title III of the ADA stipulates that entities that have a public assembly area that seats 50 people or more, or that have an amplification system and fixed seating, must provide assistive listening systems. At least 25% of the devices provided must be hearing aid compatible. The ADA offers the following table for calculating the number of ALDs needed based on seating capacity.³

Seating Capacity	Minimum Number of Receivers	Minimum Number of Hearing Aid Compatible Receivers*
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats or fraction thereof	2
201 to 500	2, plus 1 per 25 seats over 50 seats or fraction thereof	1 per 4 receivers or fraction thereof
501 to 1,000	20, plus 1 per 33 seats over 500 seats or fraction thereof	1 per 4 receivers or fraction thereof
1,001 to 2,000	35, plus 1 per 50 seats over 1,000 seats or fraction thereof	1 per 4 receivers or fraction thereof
2,001 and over	55 plus 1 per 100 seats over 2,000 seats or fraction thereof	1 per 4 receivers or fraction thereof

*If an induction loop is available, then the 25% of hearing aid compatible devices would not need to be provided. Signage should indicate the availability of ALDs and how to request them.

3 U.S. Department of Justice. (2010). *ADA standards for accessible design*. Retrieved from www.tinyurl.com/2010ADASstandard



EXAMPLE: AUDITORIUM WITH 550 SEATS

- **1 transmitter** with lapel microphone or connected to existing sound system
- **22 receivers** are the minimum number required
- **22 headphones** for receivers
- **6 neckloops** (hearing aid compatible device) are the minimum number required unless an induction loop is available.

Types of Assistive Listening Systems

Assistive listening systems deliver an enhanced sound signal from a transmitter with microphone to a receiver with a listening option appropriate for the individual user. There are portable transmitters with a lapel microphone for a single speaker and transmitters that are connected to a sound system.

Assistive listening systems differ primarily in what transmission method they use to broadcast the sound signal from the transmitter to the receiver. There are advantages and disadvantages to each type of system.



FM/DM SYSTEMS

The primary difference between FM and DM systems is how the sound signal is broadcast. FM (frequency modulation) systems use analog radio frequency to transmit sound on frequencies set aside specifically for hearing assistive technology to reduce the potential for interference. DM (digital modulation) systems digitize and compress the signal into a narrow band providing a clean signal with less possible interference.



Other than how the signal is transmitted, both systems function alike. The transmitter and receiver need to be on the same frequency or channel. The signal can travel a relatively long distance, over 100 feet, and through walls. A user can stand outside a room and still pick up the signal with the receiver.

TRANSMITTERS/MICROPHONES

Both FM/DM systems offer flexible configurations depending on the need. A transmitter can connect to a media device with an audio cable or to a lapel microphone for an individual speaker or even placed on a table for group situations. Most systems can accommodate only one transmitter, but there are systems that can be configured with multiple transmitters.



If a student will be involved in small group discussions, a system that offers a microphone on the receiver allows the user to hear from the faculty member and from the group directly around them. The microphones are controlled directly on the receiver.

It is important for portable systems to have channel selection options. If two students have portable systems and are located in adjoining rooms, there could be signal interference. The ability to change channels on one of the systems increases the flexibility of the system.

TELECOILS (“T-COIL”)

The telecoil is a feature in hearing aids and cochlear implants that picks up an induction signal and delivers the sound directly through the hearing aid/cochlear implant. This induction signal is created either by the neckloop listening option or by a large area induction loop system. The telecoil should be programmable on the hearing aid or cochlear implant (not an automatic one for phone use).

RECEIVERS

Traditional receivers have a headphone jack allowing for different listening options to be used. Headphones and neckloops are purchased as components to the assistive listening system. Audio cables that connect the receiver directly to a cochlear implant can be purchased through the manufacturer with built-in surge protection.



Wireless receivers (“couplers”) are very small and fit on the end of a hearing aid or cochlear implant. They have a universal three-prong plug to allow for direct connection. Hearing aid and cochlear implant users need a coupler that creates the connection for the wireless receiver. An audiologist should be consulted to determine the correct coupler needed for the hearing aid or cochlear implant.

Intermediary devices (“streamers”) pick up an audio signal from cell phones, accessories connected to televisions, and computers through Bluetooth technology. They convert that signal and deliver it to the user’s hearing aid or cochlear implant. Similar to Bluetooth signaling, the transmission range is 33 feet. However, this type of system is usually not viable for classroom access because of its limited range, especially in a large lecture hall. Typically, a streamer would be considered a personal amplification device because it is often used to connect to a cell phone. However, if a hearing aid or cochlear implant style does not allow for direct connection, a streamer that can accept a 3-prong jack might be suggested. The streamer then becomes part of the wireless receiver.

INDUCTION LOOP SYSTEMS

A hearing loop is a physical wire that is installed either around the perimeter of a room or section of a room that is connected to a sound source like a microphone or media. An electromagnetic signal is created and runs through the loop. In order to access the signal, a T-coil setting on the hearing aid or cochlear implant is needed. All the individual needs to do is switch their device to the T-coil setting and they will pick up the signal—**no extra equipment is needed**. Special induction loop receivers must be purchased for individuals who do not have amplification or a device that is not equipped with a T-coil.



INFRARED SYSTEMS

The sound source signal is sent on an infrared bandwidth (think of a flashlight sending a beam of light with auditory information). The signal fills the room by reflecting off the walls. This provides for privacy as the signal is contained within the room. Line of sight is important for this technology to work and it cannot be used outdoors. The transmitter with remote microphone uses an emitter to broadcast the infrared signal in the room. The receivers use either headphones or neckloop listening options.



Assistive Listening Systems 101: Student Evaluation Form

Date:	
Student Name:	
Class Title:	
Faculty Member Name:	
Type of Assistive Listening Device:	

Listening setting for this course:

- Small (< 10 people)
- Medium (11–50 people)
- Large (> 50 people)

I used these services in addition to the assistive listening device (please check all that apply):

- Notetaker
- Interpreter
- CART
- C-Print
- TypeWell

I use the following personal device(s) to connect to the assistive listening device:

- Hearing aid w/ telecoil
- Hearing aid w/o telecoil
- Cochlear implant
- Neckloop
- Streamer (for Bluetooth)
- None of the above

Scale: 1 = Always, 2 = Usually, 3 = Sometimes, 4 = Rarely, 5 = Never

1	2	3	4	5
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Faculty Member					
The faculty member understood how the ALD worked in the classroom.					
The faculty member performed a sound check at the start of class and ensured that the equipment works.					
The faculty member wore the microphone at the appropriate distance from their mouth.					
If questions or comments were made by other students in the classroom, the faculty member repeated the question or comments.					
If the faculty member was having a private conversation, they turned off the microphone.					
Disability Services Professional (DSP)					
The DSP discussed with you which assistive listening system would best meet your needs for this classroom.					
The DSP instructed you on what to do if the device needed new batteries.					
The DSP instructed you on what to do if the device stopped working, got lost, or was damaged.					
The DSP informed you of the policies for activities outside of classroom or off campus.					
Assistive Listening Device					
The microphone was able to capture the faculty member and other students' speaking during class.					
The devices had enough charge for the class.					
I was able to understand communication clearly in class.					
If I had problems, I was able to get a replacement device immediately.					
The assistive listening system allowed me to communicate freely in the class environment.					
Having the ALD helped me feel connected to the campus community.					

Would you want to continue to use this assistive listening device?

- Yes
 No
 Maybe

Please feel free to write additional comments below.

Assistive Listening Systems 101: Tips for Faculty

- Check the transmitter before beginning the lecture and **perform a quick sound check** with the student to ensure the transmitter and receiver are working properly.
- **Turn off or mute the unit** when not in use, such as when having a private conversation, before clipping or removing the unit from clothing, or when using the restroom.
- **Repeat brief comments or questions** from other students or pass the microphone to students who are making longer comments. Students using the assistive listening system will not be able to hear comments from classmates unless their classmates are speaking into the microphone.
- For group discussions, **establish group turn-taking** so that one person speaks at a time. If small groups will be talking simultaneously, try to limit background noise and have students pass the microphone in the small group.
- If the student is using an **infrared system**, work with the student to reserve seating that is ideal to receive the signal. Be mindful that infrared signals can be blocked by objects (e.g., podium, AV equipment).
- When planning to **show videos during class**, discuss with the student beforehand how the student would prefer to access the audio content (e.g., the student may want to place the receiver near the audio speaker).

Assistive Listening Systems 101: Tips for Students

- **Talk with your audiologist.** If using a personal amplification device, such as a hearing aid or cochlear implant, find out if you have a telecoil and if it is programmed. It is best to become familiar with what assistive listening systems are compatible with your device.
- **Request assistive listening devices (ALDs) through the Disability Services Office**
 - Be prepared to answer questions such as when you will need access to ALDs (classroom and nonclassroom activities) and what additional accommodations you will need in the classroom (e.g., note taker, captioned media, speech-to-text services, interpreting services).
 - Ask what you should do if the device needs new batteries, stops working, or becomes lost or stolen.
- **Prior to the start of any class, communicate with the faculty member about the use of ALDs**
 - How to handle questions during lecture
 - Most effective way to watch videos in the classroom
 - How to handle small group discussions
- At the beginning of class, **check the device** to ensure there is enough battery for the entire class and perform a sound check with the faculty member.
- For group discussions, if the faculty member hasn't established group turn-taking rules, **ask for only one person to speak at a time.** If working in small groups during class, try to find an area with limited background noise and have students pass the microphone.
- **Ask for clarification** from the faculty member or classmates whenever necessary.

Assistive Listening Systems 101: Tips for Disability Services Professionals

- **Start with an interactive dialogue with the student.** Remember accommodations should be made on a class-by-class and student-by-student basis.
- Discuss with the student the **different environments** in which they will need access to an ALS:
 - Classroom
 - Campus events
 - Social activities
- Ask about the **student's past experiences** with ALS and what worked for them. If no prior experience, be sure to explain the variety of systems available for use.
- Coordinate **additional accommodations** as needed, such as note takers, captioned media, speech-to-text services, or interpreting services.
- Offer **tips and strategies** to the student for using assistive listening devices in the classroom. (See "Tips for Students")
- Outline any **policies and procedures** related to ALS:
 - How to request more batteries
 - What to do if the device stops working
 - How to report if the device is lost, damaged, or stolen
 - Use of device off campus
- **Test assistive listening equipment** on a regular basis. Remove batteries when equipment is not being used to avoid corrosion.
- If your system is **outdated or dysfunctional**, consult with an independent audiologist or assistive listening system manufacturer when purchasing new devices to ensure your institution is investing in current technology.

Comparison Tool

	Infrared	FM System (radio signal)	DM System (digital frequency)	Permanent Induction Loop
Pros	<p>Portable</p> <p>Signal is secure</p> <p>Wireless connection</p>	<p>Portable</p> <p>Large area systems can be connected to sound system</p> <p>Can be used outdoors</p> <p>Wireless connection</p> <p>Long range to accommodate classroom settings</p>	<p>Portable</p> <p>Signal is secure</p> <p>Can be used outdoors</p> <p>Cleaner signal than FM system</p> <p>Wireless connection</p> <p>Long range to accommodate classroom settings</p>	<p>For telecoil user, no additional devices needed</p> <p>Limited maintenance needed after initial set up</p> <p>Wireless connection</p>
Cons	<p>Cannot be used outdoors</p> <p>Not effective for small group meetings</p> <p>Speaker comfort with using microphone is mixed</p> <p>Regular maintenance needed</p>	<p>Signal is not secure</p> <p>Speaker comfort with using microphone is mixed</p> <p>Regular maintenance needed</p>	<p>Speaker comfort with using microphone is mixed</p> <p>Regular maintenance needed</p>	<p>Start up cost is high</p> <p>Special receivers needed for users without telecoil</p> <p>Not portable</p> <p>Typically used for large venues only</p>
Ideal Settings	<p>Large classrooms</p> <p>Meetings where privacy is important</p>	<p>Small groups</p> <p>Large classrooms</p> <p>Auditoriums</p>	<p>Small groups</p> <p>Large classrooms</p> <p>Auditoriums</p>	<p>Large classrooms</p> <p>Auditoriums</p> <p>Theaters</p>
How sounds can be received by the user	<p>Receiver with a neckloop for hearing aids and cochlear implants with telecoil</p> <p>Receiver with headphones for hearing aids and cochlear implants without telecoils or for people without hearing aids</p>	<p>Receiver with neckloop for hearing aids and cochlear implants with a telecoil</p> <p>Receiver with headphones for hearing aids and cochlear implants without telecoils or for people without hearing aids</p> <p>Miniature receiver that connects directly to hearing aids, cochlear implants or a streaming device</p>	<p>Receiver with neckloops for hearing aids and cochlear implants with telecoil</p> <p>Receiver with headphones for hearing aids and cochlear implants without telecoils or for people without hearing aids</p>	<p>Loop receiver with headphones for hearing aids and cochlear implants without telecoils or for people without hearing aids</p> <p>Telecoil users need no additional device</p> <p>Personal streaming device with a built-in telecoil</p>
Can multiple microphones be connected?	No	Some portable systems support multiple transmitters/ microphones	Some portable systems support multiple transmitters/ microphones	No
System Components Needed	<p>Transmitter with microphone (or connection to audio system)</p> <p>Infrared receiver with neckloop or headphones</p>	<p>Transmitter with a microphone (or a connection to audio system)</p> <p>Traditional FM receivers with a neckloop or headphones</p> <p>Miniature receivers with audio boots that connect to hearing aids or cochlear implants</p>	<p>A transmitter with microphone (or connection to audio system)</p> <p>Traditional DM receiver with a neckloop or headphones</p>	<p>Transmitter with a microphone (or connection to audio system)</p> <p>Loop receiver with headphones for hearing aids and cochlear implants without telecoils or for people without hearing aids</p>