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Renee A. Middleton
West Georgia College

Letitia Ekhaml
West Georgia College

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A SELECTIVE STUDY OF THE UTILIZATION OF VARIOUS ASSISTIVE LISTENING DEVICES IN SCHOOLS, LIBRARIES, AND HOSPITALS

**Renee A. Middleton
and
Letitia Ekhaml
West Georgia College
Carrollton, GA**

Current citizen groups, action committees, and government legislatures who focus on equal opportunities and services for the handicapped have led to the widespread use of assistive listening devices in various public and private institutions.

The National Association for Hearing and Speech Action listed in its 1983 published directory 399 schools, libraries, hospitals/homes, churches, theaters, and museums utilizing various assistive listening devices.

Virtually all assistive listening devices use microphones that are designed to be worn or held by the principal speaker in a fixed position. Because the microphone is in a fixed position, a relatively constant distance is maintained between the principal speaker's mouth and the microphone, which provides a controlled sound pressure level to the listener's ear. Because of this, the acoustic signal is less affected by distance, environmental noise, and other interfering factors.

Assistive listening devices utilized in special or regular educational classrooms are referred to as auditory trainers.

Three popular assistive listening devices, i.e., auditory trainers, are:

1. **Audio loop.** A popular term used for induction loop systems. It transmits signals through wires around the room, usually in the ceiling or on the floor under the carpet, to the T-switch (telephone) circuit in the listener's hearing aid or through a hand-held wand receiver.
2. **Freefield FM system.** A radio frequency auditory training unit which picks up the principal speaker's voice and transmits it to the individual's receiver unit through small earphones or personal hearing aids.
3. **Infrared system.** Consisting of invisible light, infrared emitters are mounted in a designated room and the individual

receiver's unit picks up the speaker's voice. The signal can be cancelled out by light.

Several questions were asked at the outset of this study. Which type of assistive listening devices are being used in schools, libraries, and hospitals? Who uses them? Where and how are assistive listening devices being used? What are the characteristics and advantages and disadvantages of the various assistive listening devices in these institutions? What kinds of problems are associated with the use of these devices? Which device(s) would be recommended for purchase by the users? The purpose of this study was to determine the answers to these questions.

METHOD

A survey questionnaire was designed and distributed to 83 institutions (60 schools, 15 hospitals, and 8 libraries) listed in the *Directory of Assistive Listening Devices* (1983) prepared by the National Association for Hearing and Speech Action (NAHSA). This listing includes those listed in the updated supplements put out by NAHSA. Even as this article was being written, a newer directory was being published and made available to the public.

The written questionnaire consisted of 14 fixed-alternative and open-end items which was sent in early November 1985. There were 56 returns, a response rate of 67%. Out of these 56 returns, five were eliminated from the data analysis. These five indicated that they were not using any type of assistive listening devices, even though their institutions were cited in the directory.

A detailed listing of those who responded to the questionnaire may be found in Appendix A. The respondents included in the study were 42 schools, 4 hospitals, and 5 libraries.

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RESULTS

Type of Assistive Listening Device Used in Each Setting

Asked which type of assistive listening device(s) they are using, the majority of the schools (37 or 88%) indicated they were using freefield FM systems. Of these, 43% reported utilizing Telex FM auditory training systems, another 43% reported utilizing Phonic Ear FM auditory training systems. Fourteen percent (14%) did not indicate the system(s) they were utilizing. Only 16% of the schools reported using audio loop systems, while only 12% used infrared systems. It should be noted that some of the respondents used more than one system.

Eight libraries were on the list. Three returned the questionnaire, however, stating they were not utilizing any type of assistive listening device. This cut the total number of respondents down to five. Of these, 80% (four out of five libraries) returned their questionnaires. All of these respondents utilized audio loop systems, the majority of which were home-made. None of the libraries studied reported using freefield FM or infrared systems.

Of the fifteen hospitals listed, three returned their questionnaires indicating they were not using any type of assistive listening device. This cut the total number of possible respondents down to twelve. Of these twelve, five returned their questionnaires. From this group, 80% (four out of five) indicated they were utilizing audio loop systems, which were also home-made. Only 25% of the hospitals reported using freefield FM systems and another 25% reported using infrared systems. Table 1 gives a quick overview of the type of assistive listening devices used in schools, libraries, and hospitals.

TABLE 1

Type of Assistive Listening Devices Used in Schools, Libraries, and Hospitals

Type of Devices	Schools N = 42		Libraries N = 5		Hospitals N = 4	
	F	%	F	%	F	%
Audio Loop	7	16%	4	80%	4	100%
Freefield FM System	37	88%	0	0%	1	25%
Infrared System	5	12%	0	0%	1	25%
Other	3	7%	0	0%	1	25%

*N = Total number of respondents

*F = Frequency of responses

Where the Assistive Listening Devices Are Being Used

On the question, "In which location is the assistive listening device being used?", the majority of the schools indicated they were using them in classrooms (90% response rate) and auditoriums (52% response rate). All four hospitals studied indicated their assistive listening devices were being used in auditoriums, while three out of five libraries (a 60% response rate) said their devices were being used in public meeting rooms. Other locations were mentioned. Refer to Table 2 for a more detailed list.

TABLE 2

Location of Assistive Listening Devices in Schools, Libraries, and Hospitals

Location	Schools N = 42		Libraries N = 5		Hospitals N = 4	
	F	%	F	%	F	%
Classroom	38	90%	0	0%	1	25%
Library or Media Center	17	40%	0	0%	0	0%
Auditorium	22	52%	2	40%	4	100%
Conference Room	7	16%	0	0%	1	25%
Lounge	3	7%	0	0%	1	25%
Waiting Room/ Reception Area	2	4%	0	0%	1	25%
Meeting Room	5	12%	3	60%	0	0%
Others (Chapel, dining room, treatment area, etc.)	1	2%	0	0%	4	100%

*N = Total number of respondents

*F = Frequency of responses

Characteristics of Assistive Listening Devices

Respondents were given a checklist of possible characteristics applicable to the particular assistive listening devices they were using. The results are reported in Table 3. Infrared systems appear to be the systems of choice in terms of durability, ease of operation, maintenance, and technical quality (fidelity). FM-systems are the choice systems where portability (mobility) is concerned.

Type of Audiences Using the Assistive Listening Device

The majority of the respondents in the schools said that their hearing-impaired students and normally hearing teaching staff were the ones utilizing the assistive listening devices in their institutions. The majority of the respondents from the hospitals indicated that their

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TABLE 3
Positive Characteristics of Assistive Listening Devices Reported by Schools, Libraries, and Hospitals

Characteristics	Audio Loop	Infrared	FM System
Ease of installation	50%	50%	N/A
Portability/mobility	0%	0%	100%
Durability	67%	100%	70%
Ease in Operation	58%	100%	70%
Ease in Maintenance	58%	100%	49%
Affordability	33%	16%	16%
High Fidelity/ Technical Quality	0%	100%	68%
Other	NR	NR	NR

Note: Scores can be interpreted as follows:
0-50% = poor, 50-65% = fair, 65-70% = good,
70-100% = excellent.

hearing-impaired patients were the ones availing themselves of the assistive listening devices while two hospitals (half of the respondents) reported that their normally hearing administrative staff members were using the devices in order to demonstrate to hearing-impaired patients application possibilities in their homes and communities. Four out of five libraries studied indicated that their hearing impaired patrons were the ones utilizing their devices. They did not cite any normally hearing individuals as users of the devices for their personal needs.

A complete breakdown of hearing-impaired and/or normally hearing users can be found in Table 4.

TABLE 4
Type of Audience Using the Assistive Listening Devices in Schools, Libraries, and Hospitals

	Schools N = 42		Libraries N = 5		Hospitals N = 4	
	F	%	F	%	F	%
A. Hearing Impaired Individuals						
Administrative Staff	8	19%	0	0%	0	0%
Teaching Staff	15	36%	0	0%	0	0%
Clerical Staff	5	12%	0	0%	0	0%
Students	25	60%	0	0%	2	50%
Clients/Patients	6	14%	1	20%	3	75%
Other	4	10%	4	80%	1	25%
B. Normal Hearing Individuals						
Administrative Staff	6	14%	0	0%	2	50%
Teaching Staff	23	55%	0	0%	0	0%
Clerical Staff	4	10%	0	0%	0	0%
Students	6	14%	0	0%	0	0%
Clients/Patients	1	2%	0	0%	1	25%
Other	0	0%	0	0%	0	0%

*N = Number of respondents

*F = Frequency of response

How the Assistive Listening Devices Are Being Used

Asked how the assistive listening devices are being used in their particular setting, the majority of the schools (71%) said that they were used for instructional purposes in the classroom. Only 19% of the schools reported use of the systems for plays, musicals, lectures, movies, concerts, and commencement exercises in auditoriums and 17% of the respondents from the schools reported use of the systems in speech therapy and auditory training. The majority of the libraries (88%) said their assistive listening devices were being used in public meeting rooms by hearing-impaired groups during meetings, lectures, workshops, and film programs. Respondents from hospitals gave varied answers. They indicated that the devices were used during devotions, special events, recreation, informational meetings, and training programs.

Problems Encountered By Users

When respondents were asked what specific problems they experienced with their particular assistive listening device(s), problems encountered were minimal, on the whole (see Table 5). The majority of the respondents (94%) said they would recommend the purchase of the specific assistive listening device(s) they were using. A detailed view of the specific problems and particular systems utilized by schools, libraries, and hospitals are reported as follows:

Schools: The schools were the only ones reporting the use of FM-Systems as indicated in Table 5. As was mentioned earlier, problems reported were minimal. Seventeen percent (17%) of these schools responding utilized audio loop systems. Of these, 43% indicated they had problems with cross-talk between rooms and 29% reported having problems because of limited mobility. Fourteen percent (14%) reported problems with marketing their system for the greatest number of users, maintenance of equipment, problems with abuse or vandalism, and poor acoustical performance. Twelve percent (12%) of the schools utilized infrared systems. Minimal problems were reported.

Libraries: All five libraries studied utilized audio loop systems. The majority of them indicated they were not experiencing any known problems with their systems. One library did indicate obtaining poor acoustical performance

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from the system. However, it should be noted that the system was reported to have been "rigged up" by the library technicians with the assistance of a nearby university.

Hospitals: Eighty percent (80%) indicated they were utilizing audio loop systems. Fifty percent (50%) indicated they had problems with training individuals to use the systems and with matching the loop system with an individual's personal hearing aid (listed as other). Twenty-five percent indicated they were utilizing an infrared system to demonstrate various assistive listening devices to their hearing-impaired clients. The hospitals reported having no problems with their infrared systems.

TABLE 5

Problems Encountered with Assistive Listening Devices Used in Schools, Libraries, and Hospitals

Problem	AL	IR	FM ^o
Difficulty in installation	0%	17%	0%
Difficulty in maintaining	13%	17%	14%
Poor acoustical performance	20%	17%	3%
Cross-talk between rooms	27%	17%	0%
Limited Mobility	27%	0%	0%
Daylight interference with sound quality	0%	17%	0%
Frequency of equipment breakdown	0%	17%	19%
Training of users	20%	17%	16%
Problems with abuse or vandalism	0%	17%	16%
Availability of individuals to repair	0%	0%	11%
Other	13%	17%	05%

*AL (Audio Loops); IR (Infrared); FM (Freefield FM-Systems)
^o(Schools only)

Remedies for Problems

Infrared: When asked what was done to remedy the various problems encountered, the response was that in some cases, there was very little that could be done if the problem dealt with the basic characteristic, function, or nature of the equipment. Suggestions for avoiding problems were as follows:

- a. Carefully training equipment attendants to check for damage and abuse to equipment.
- b. Putting shades on the windows to cut down on daylight interference with sound quality.

- c. Mentioning the system in press releases, public service announcements, and other personally prepared printed matter to promote wider use of the system.

Audio-Loop: Respondents suggested:

- a. Avoid using audio-loops in adjacent rooms to cut down on cross-talk between rooms.
- b. Post signs strongly stating not to touch equipment and carefully locking doors to help eliminate problems of abuse and/or vandalism.
- c. Utilize FM equipment for specific applications where mobility becomes a problem, e.g., field-trips, playground, etc.
- d. Provide inservice training by a qualified representative or audiologist to train users of the equipment.
- e. Make efforts to obtain funds to "update" hearing aids of residents and/or students to enable them to make use of audio-loop systems.
- f. Encourage student participation in educating staff and parents about the system, increase staffing positions and request additional monies for the purpose of maintenance and upkeep of the equipment.

FM-Systems: Suggestions were as follows:

- a. Provide inservice training to staff, students, and parents in the care and use of equipment (suggestions ranged from a one-time inservice to yearly to ongoing inservices).
- b. Train teachers to troubleshoot equipment, maintaining a supply of spare parts (batteries, cords, receivers), referring problems to an audiologist, and maintaining a service contract for handling problems when the breakdown of equipment occurs.

DISCUSSION

Infrared systems would appear to be the system of choice in terms of durability, operational ease, ease in maintenance, and signal quality (see Table 3). These systems provide a signal quality that can be described as stereophonic. Infrared systems are being considered for school use for lectures, movies, plays, concerts, and other similar activities. In this study, those schools utilizing infrared systems used them for just that purpose. One hospital used the device for demonstration and awareness purposes for their hearing impaired clients. As this study

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indicates, these systems are not portable and are very expensive. For these reasons, this type of system has not been widely accepted for use in the education of hearing impaired students. The system should not be overlooked, however, for use with both normally hearing and hearing impaired individuals in public places such as civic centers, museums, lecture halls, auditoriums, theaters, etc., where mobility would not be a consideration and the quality of sound is of utmost importance. An infrared system would distribute an even stereophonic sound quality to all parts of the specified setting or environment to all listeners regardless of the particular seating arrangements. Hospitals should consider the wider use of infrared systems for the reasons reported above.

FM systems are the systems of choice in terms of portability and they require no special installation. They were also judged to be excellent systems in terms of durability and ease of operation (see Table 3). Only forty-nine percent (49%) of the respondents utilizing this device rated these systems as being easy to maintain. As these systems received an excellent rating of durability, maintenance problems are assumed to be due more to the students' and staff members' unfamiliarity in the operational use of the equipment. Maintenance problems are attributed more to the limited knowledge on the part of the teachers and students in terms of the care and use of these systems rather than with problems with the equipment itself. Many of the respondents expressed the need for in-service training in the care and use of the FM-systems for staff, students, and parents.

It is clear from this study that the biggest problem with *audio loop* systems is the problem of high fidelity (see Table 3). According to Pollack (1980), when this quality is present, it is indicative of an accurate or near accurate reproduction of the input signal. Low fidelity is characteristic of those systems which tend to distort the output signal in relation to the input signal. Audio loop systems were reported as providing poor signal quality. Respondents in school systems also reported problems with cross-talk between rooms, i.e., the students often received the voices of teachers in the rooms adjacent to them. They also indicated that many times their hearing aids were not always compatible with the loop system because students' aids did not always have a T-switch. As this study indicates,

audio loop systems have almost been completely superseded in the schools for the education of hearing impaired children by freefield FM systems.

In this study, only seven out of 42 schools reported using audio loop systems. Audio loop systems also lack the quality of being portable. This study did indicate, however, that hospitals and libraries in particular were placing great reliance on the use of these systems and they reported having no significant problems with their systems. The success of this system in other settings would seem to indicate that their loop systems have, for the most part, been properly designed and installed to match the components of individual hearing aids. It is unlikely, however, that these systems will ever regain popular use as auditory training systems in the schools.

SUMMARY

The purpose of this survey was to determine which type of assistive listening devices were being used in schools, libraries, and hospitals. It examined who the users were, where the devices were being used, and how they were being used. The characteristics, advantages, disadvantages, and problems associated with the use of the various assistive listening devices were also studied. Forty-two schools, four hospitals, and five libraries participated in the study.

The majority of the schools use freefield FM systems, while the majority of libraries and hospitals utilize audio loop systems. The majority of the schools are using their assistive listening devices in the classrooms for instructional purposes and in auditoriums for plays, musicals, concerts, and the like. Most of the libraries are using them in the public meeting rooms for meetings, workshops, and film programs. All the hospitals studied are using their devices in the auditoriums for special events, meetings, training programs, and the like.

The audio loop systems are described as being good in terms of durability, but fair in terms of operational ease and maintenance. Infrared systems are thought to be excellent in terms of durability, fidelity, ease in operation, and maintenance. The FM systems are considered by the respondents to be the most mobile/portable, good in terms of durability, operational ease, and technical quality.

The majority of the respondents from the

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schools said that the hearing impaired students and the normally hearing teaching staff were the ones utilizing their assistive listening devices. The hearing impaired patients from the majority of the hospitals studied and the normally hearing administrative staff from half of the hospitals studied are users of the assistive listening devices. The majority of the libraries said that the hearing impaired patrons are the ones utilizing the devices.

In terms of the problems encountered, the majority of the hospitals utilized audio loop systems. Half of the hospitals reported having problems training individuals to use the system and with matching the audio loop systems with the individual's personal hearing aid. The majority of the schools utilized personal FM systems. A few of the schools reported problems with breakdown of the equipment. All libraries reported utilizing the audio loop system and no significant problems were reported. Remedies were provided for specific problems encountered which may be of benefit to institutions utilizing these various assistive listening devices.

RECOMMENDATIONS

It was determined that infrared systems were not being widely used by either schools, libraries, or hospitals. Institutions should consider utilizing infrared systems where outside mobility would not be a major consideration and the quality of sound is of greater importance. These systems provide an even stereophonic distribution of sound.

Auditory FM systems continue to be the systems of choice for use in the education of the hearing impaired student. Primarily, this is because the FM system provides more versatility in terms of portability and mobility. Educational institutions do not have to give up these qualities in place of high fidelity. FM systems also require no special installation.

It is hoped that the information contained in this study will aid in guiding institutions in choosing an assistive listening device that will be appropriate for their particular needs. It is also hoped that many more institutions will begin to realize the benefits of utilizing such devices.

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