

Task Force 5: Standards for Auditory Training Units

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General Objectives of Auditory Training

A variety of objectives are possible when an auditory training system is employed by a teacher, clinician, and/or parent. Among these are: (a) improving gross awareness of and appropriate response(s) to environmental sounds; (b) increasing reception, recognition, identification and discrimination among environmental noises and, ultimately, among simple and complex speech signals; (c) teaching phonologic, semantic, morphologic and syntactic components of language as produced by others or self-generated; (d) improving speech perceptual and or listening skills; (e) developing increased tolerance for amplified sound; (f) determining and utilizing the dynamic range of individual listeners via optimal talker-microphone distances and or by appropriate compression amplification; (g) and other theoretical or operational objectives, e.g., development of skill in localization of the source of environmental signals.

General Types of Systems

Several basic systems can be employed for any or all of the above objectives. The individual hearing aid is used either for face-to-face communication or as the receiver for inductance or electro-magnetically transmitted signals. The traditional "hard wire" audio amplifier with a teacher's microphone and multiple earphones with individual volume controls has been employed to some extent for many years, particularly in residential schools for deaf children. Self-contained desk units and portable amplifiers also have been used for a variety of face-to-face applications.

In contrast to the above traditional systems, the past decade has brought about an increasing interest in several types of "transmitter-based" systems. That is, in order to eliminate the reduced mobility caused by cumbersome wires, to reduce the need for heavy and uncomfortable earphones, and to improve the speech-to-noise ratios delivered to individual listeners, inductance loop (IL) and radio-frequency (RF) systems have been designed and evaluated for use primarily in educational situations.

The IL and RF systems, though having potential advantages when compared to the traditional units, are not necessarily without their unique problems. Some of the important potential benefits and limitations of different types of auditory training units have been described and investigated during recent years.

Advantages and Limitations

Bellefleur (1969) has contrasted some of the pros and cons associated with the various systems, indicating that the choice among types of units quite often is related to one's educational philosophy rather than to isolated consideration of just the electronic / acoustic characteristics. He makes the following observations: First, the individual hearing aid can be used in all situations, providing essentially constant acoustic information and a means for monitoring of one's speech. A major limitation, however, is that the listener is unable to overcome intensity changes as distance between the talker and the hearing aid's microphone is increased. Second, the "hard wire" audio amplifier can be used with groups and delivers a wider range of frequencies than an individual aid. The intensity of speech delivered to the child remains the same if the teacher maintains a constant distance from her microphone; however, the child may be immobilized by connecting wires, and the earphones may be cumbersome and uncomfortable.

Third, the IL systems are versatile, simple, practical and economical. The child uses his own aid both in and out of the classroom, thus receiving a potentially consistent signal throughout the day. Major problems with the IL systems have been "spillover" between adjacent classrooms and changes in signal level due to changes in the relative positions of the "loop" and the magnetic coil in the hearing aid. Bellefleur recommends that the hearing aid have a three-position switch (microphone, coil, and microphone coil) for maximum versatility. Fourth, and finally, he indicates that the RF devices (AM or FM) function similar to a radio station, that is, the teacher has a microphone-transmitter and each child has a receiver-amplifier tuned to the specific broadcast channel being utilized by the teacher. Mobility and fidelity are primary positive features here, but inconsistent signals and the inability to monitor one's own speech and to hear voices of classmates are two practical disadvantages.

Bellefleur summarizes his observations and indicates that when selecting auditory training equipment, three questions should be answered: what is one's philosophy of training, what units fit this philosophy, and what compromises must be made? He offers the following generalizations: For mobility and good fidelity, the RF carrier systems; for superior fidelity and control, the conventional amplifiers; for realism and consistency in *group* teaching, the IL systems; and for realism and consistency in face-to-face situations, the individual hearing aid. He adds, perceptively and realistically, that the only real "auditory trainer" in the classroom is the teacher.

Relatively little research has been reported dealing with characteristics of and variables associated with the different types of auditory training systems. Krebs, Griffing and Hayes (1968) conducted a major descriptive project and summarized their observations in the report, Educational Amplification Response Study (EARS). They examined nine different commercial brands of auditory training systems (twenty-seven different models) via acoustical, quality control, and educational analyses. Physical measures were similar to those used for studying describing hearing aids (i.e., acoustic gain, frequency response, maximum power output, harmonic distortion, and compression

characteristics). They list 18 recommendations (pp. 205-206) based on their results and interpretation. Many of the recommendations were aimed at equipment manufacturers but approximately half were directed toward school systems, teachers, teacher training programs, and audiologists.

More recently, Matkin and Olsen at Northwestern have reported their evaluations and observations with IL and RF systems in classroom installations. In one study (1970a), they examined six ILA systems in ten classrooms, and found large variability among systems and interaction of many variables. They concluded that only two installations were "satisfactory". In a second report (1970b), they noted reduced efficiency of ILA systems indicated by a change in output and response when the hearing aid is switched from microphone to telephone coil positions. They further observed a lack of sophistication by teachers regarding equipment, and attributed this situation to too little preparation being provided by university training programs. In addition, the information provided by manufacturers often is too ambiguous or insufficient to be of practical value to the teacher. They commented further on these topics (1971a), emphasizing the importance of room acoustics for effective functioning of auditory training systems. Finally (1971b), they evaluated three groups of RF systems and found that two of the three groups performed quite well with respect to broad and flat frequency responses, adequate acoustic gain, and consistency across operational conditions.

General Recommendations

Recommendations offered for discussion and consideration at the Bandera and subsequent ARA meetings include the following:

1. ARA should establish a Writing Group to draft a prototype "standard" for auditory training units. This standard should have at least two sections:
 - a. recommended technical (engineering) data
 - b. recommended operational information, keeping technical vocabulary and definitions at a minimum, e.g., aimed toward a non-technical user.
2. The above Writing Group should seek input from manufacturers and engineers, and from potential purchasers and users of the equipment (teachers, administrators, audiologists and speech pathologists).
3. Draft copies of the prototype standard should be submitted to representatives of the above professional groups for constructive criticism.
4. ASHA and teacher organizations should be urged to support these efforts in liaison possibly with their standards committees.
5. Possible inclusion of acceptable noise background and reverberation characteristics for optimal classroom acoustics should be considered for this standard.
6. Effort should be expended to encourage university training programs to include "appropriate" course content for audiologists and teachers regarding both auditory training and the equipment required.

7. The topic seems of such long-standing, as well as contemporary, importance that a workshop, conference or some such means be found to bring together experienced engineers, audiologists and teachers for in-depth study of the problems and with proceedings published in a formal report.
8. Research, obviously, is needed for definition of technical limitations as they now or potentially exist and for comparative study of reliability and operational problems associated with specific types of systems.

Discussion

During the discussions in Bandera, general agreement with the need and scope of this undertaking was expressed by the participants. Given the diversity and complexity of the issues, however, and problems involved in specification of "standards" for auditory training systems, discussion was necessarily aimed toward general description of personal experiences with specific systems, toward expression of philosophical and or experiential biases for or against auditory training units, and toward affirmation of the need for additional research and exploration of this topic by ARA members and others.

Specific additional recommendations elicited for consideration were as follows:

9. Actual professional users of specific systems should be contacted for their personal observations regarding these units. Manufacturers should be asked to provide lists of purchasers, and a questionnaire, or some similar mechanism, should be used to formalize the knowledge and recommendations of persons having field experience with the various types of auditory training units.
10. This ARA committee on standards for auditory training units should coordinate its efforts with established and related committees in the American Speech and Hearing Association, e.g., Committee on Audiologic Standards (William Melnick, Chairman) and Committee on Audiometric Evaluation (Norma Hopkinson, Chairman); subcommittee on Electroacoustic Characteristics, (Zahryl Schoeny, Chairman).
11. Because of commonality of topics and complexities of issues, this ARA committee should be expanded in the near future and should work closely with other related Task Force Committees in ARA, i.e., Standards for Hearing Aids (Janet Jeffers, Chairman) and Proper Use of Auditory Training Units (Mark Ross, Chairman).

Implementation of the latter recommendation was initiated in Bandera, and respective chairpersons will coordinate subsequent activities. Organization of a combined agenda for the October meeting (at ASHA) of these committees was proposed.

REFERENCES

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