THE FUNCTIONAL LISTENING EVALUATION

Purpose of the Functional Listening Evaluation (FLE)
The purpose of this evaluation is to determine how listening abilities are affected by noise, distance, and visual access in an individual's natural listening environment. The FLE can also be used as a validation tool to demonstrate the benefits of hearing assistance technology. It is designed to simulate listening ability in situations that are more representative of actual listening conditions than can often be replicated in sound booth assessment. Through observation of the administration of the evaluation, the student's teachers, parents, and others may gain appreciation of the effects of adverse listening conditions encountered by the student. When comparing performance without and then repeated with the addition of the hearing assistance technology, the evaluation results provide evidence of the benefits of the device in enhancing access to the desired input. The FLE format may also be useful in justifying other accommodations, such as sign language or oral interpreting, notetaking, captioning, special seating, and room acoustic modifications. This protocol is based on a listening paradigm suggested by Ying (1990), and by Ross, Bracken, and Maxon (1992).

Materials Needed
Cassette Tape Recorder, CD player, or laptop computer to play noise source
Sound Level Meter - use A weighted scale
Noise Tape, CD, or .wav sound file - classroom noise or multitalker is recommended
Word/Phrase/Sentence Lists for test stimuli
Tape measure
Tripod or stand to hold sound level meter (optional)
Masking tape or marker (optional)

Environment for Testing
Use the student's classroom during a time when students are not present. If this is not possible, choose a room that most closely approximates the size, ambient noise level, and floor and wall surfaces of the student's classroom. While performance during actual class sessions would seem ideal, the test process itself may be disruptive to instruction for the rest of the class and therefore may not reflect the true listening conditions encountered by the student throughout the day.

Physical Set-up of Test Environment
Due to room size and instructional style variations, the occupied classroom should be observed to determine maximum listening distances. The distance used should be recorded on the scoring form. These distances can be marked using masking tape on the floor. Be sure that the markers are from the student's ear to the examiner's mouth.

Close: Noise and examiner are 3 feet in front of the student (see Diagram A).
Distant: Noise remains 3 feet in front of the student; examiner moves back to the pre-determined distance [12 to 15 feet in this example] from the student (see Diagram B).

Diagram A.

Diagram B.
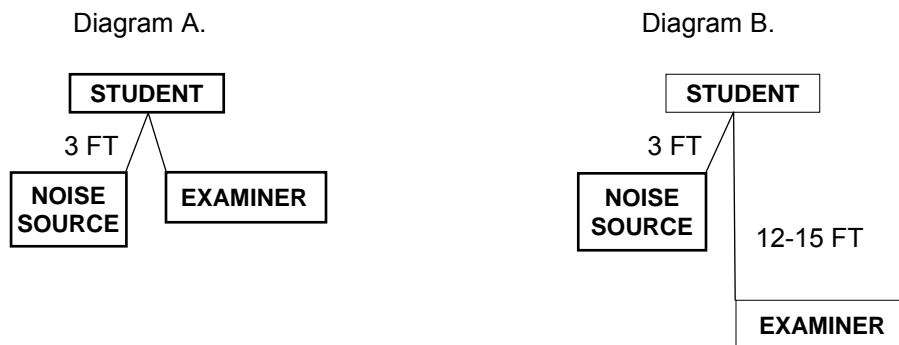
Types of Evaluation Materials

In order to simulate classroom listening ability, the evaluation material utilized should approximate material that is encountered by the student in the classroom. Additionally the stimuli should have sufficient length to reflect reverberation characteristics of the room. Consideration should also be given to both familiar and new material that a student may encounter. Individuals will usually perform better with familiar material than with stimuli containing unfamiliar vocabulary. Individuals with unilateral and mild hearing losses tend to perform well under all conditions due to the audibility and inherent redundancy in phrase and sentence material utilizing familiar vocabulary. Nonsense phrases have been constructed to decrease these performance effects.

Age, limited language, and memory abilities of the individual should also be considered when determining the test stimuli. In selecting word, phrase or sentence materials, consider whether the vocabulary and syntax are appropriate for the student's language ability. For students with poor speech intelligibility, as well as young children, it may be necessary to use materials that incorporate picture-pointing responses. If closed-set materials are utilized, performance can be expected to be better than with open-set materials. Once the type of stimuli is determined, it must remain constant throughout the assessment so that the variables manipulated are noise, distance, and visual input. Report the material used on the scoring form.

Sentence Materials:	BLAIR Sentences	WIPI Sentences
	SPIN Sentences (older students)	BKB Sentences
	PSI Sentences	
Phrase Materials:	Common Children's Phrases	Children's Nonsense Phrases
Word Lists:	PB-K	NU-6
Picture – Closed Set:	WIPI	NU-CHIPS

Note: All of the above phrase and sentence materials are available in the Educational Audiology Handbook (2nd ed.) (Johnson & Seaton, 2012); word lists are available through your local audiologist.

In many of the above materials there will not be sufficient lists for the entire protocol (8 lists are needed). If it is necessary to use a list twice, select the lists that were more difficult for the student in order to reduce familiarity with the material. The Common Children's Phrases and the Children's Nonsense Phrases each contain eight lists and provide the option of phrase or word scoring.

Presentation Levels

Speech to noise levels should be based upon the auditory environments encountered the students in their classrooms. Sound level measurements of classroom discourse and activity may be necessary to determine these levels. For this example, the levels below will achieve values resulting in a +5 dB speech advantage in the close condition and a –5dB speech to noise level in the distant condition (12-15ft). Levels will vary slightly depending upon the acoustics of the room and consistency of the examiner's voicing of the stimuli. Record the classroom ambient noise level (unoccupied) and approximate teacher or speaker levels and noise levels on the scoring form.

Speech: Calibrate the examiner's voice at a distance of 3 feet from the listener (close condition) by measuring the examiner's voice with the sound level meter so that speech averages 65dBA SPL at the listener's ear. Once that level is measured, it helps to determine the SPL level when the sound level meter is one foot from the examiner's mouth (being careful to keep the voice level the same) so that the examiner can hold the sound level meter to monitor his/her voice for all conditions to verify that the proper speech level is maintained. The level at 1 foot from the examiner will be approximately 6 dBA SPL greater that at listener's ear for close conditions).

Noise: Using a sound level meter, adjust the volume of the noise source that is located approximately 3 feet from the student, so that the classroom/multitalker noise averages 60 dBA SPL at the student's ear. This yields a +5 speech-to-noise level.

Presentation Protocol

The evaluation should be conducted in the student's typical hearing mode. If hearing aids or cochlear implants are usually worn at school, they should also be worn during the evaluation. When this evaluation is used as a validation tool to demonstrate the improvement in listening ability with FM or other hearing assistance technology, the examiner may need to only repeat the noise and distant conditions to demonstrate the benefits of the device.

Eight phrase, sentence or word lists should be presented in the order indicated by the numbers on the scoring matrix. This order balances for difficulty across conditions so that the final task is the easiest of the distance conditions. The examiner may choose to alter the order for other reasons however.

The examiner should present the speech materials at a normal speaking rate. The listener repeats the test stimuli or points to the appropriate picture, as dictated by the material used.

Test administration takes approximately 30 minutes, including set up.

1.	Auditory-Visual:	Close	Quiet	5.	Auditory-Visual:	Distant	Noise
2.	Auditory:	Close	Quiet	6.	Auditory:	Distant	Noise
3.	Auditory-Visual:	Close	Noise	7.	Auditory:	Distant	Quiet
4.	Auditory:	Close	Noise	8.	Auditory-Visual:	Distant	Quiet

Repeat noise and distant conditions to validate benefit of hearing assistance technology.

Scoring

Scoring should be completed using the protocol established for the selected test materials. All scores should be reported in percent correct in the Scorebox. Hearing assistance technology scores can be entered in the lower part of the Scorebox for the conditions repeated. The scores for the interpretation matrix will be automatically transferred and calculated.

Variations in Protocol

This protocol is based on the listening situation of a typical classroom. For an individual student, it may be useful to modify this protocol to account for variations in the level and source of noise, classroom size, teacher's voice, typical listening distances for the student, or other factors. In order to accommodate these variations, the following modifications may be considered. Modifications other than distance and speech and noise levels should be noted on the test form.

Placement of noise source	Level of noise
Distance of examiner from student for the distant condition	Order of presentation

Interpretation Matrix

The Interpretation Matrix analyzes the effects of noise, distance, and visual input for the various conditions. Individual scores are averaged to determine the overall effect of each condition. Hearing assistance technology scores are entered in the lower portion of the boxes. Although scores may be affected by different speakers, rate of speaking, attention of the listener, or status of amplification, as long as these variables are kept constant throughout the evaluation, comparisons are valid.

When validating hearing assistance technology, the target for desired performance is the score from Scorebox 1 (for auditory visual) or Scorebox 2 (auditory only). In other words, the effects of noise and distance can be considered eliminated when the performance with the device matches the individual's best performance in quiet or reduced if the performance is improved. This information can be used as evidence to justify technology and other accommodations that may be beneficial for the student. The findings should be discussed with the student, his/her parents, and teachers to help them understand the student's listening abilities and needs. A summary of the Interpretation Matrix and appropriate recommendations should be included on the scoring form.

References

Auditec of St. Louis, Multitalker Noise Tape. 2515 S. Big Bend Blvd., St. Louis, MO 63143-2105; 800-669-9065, www.auditec.com

Johnson, C.D. & VonAlmen, P.(1993). The Functional Listening Evaluation. In *Educational audiology handbook*, (pp 336-339). Johnson, Benson, & Seaton (1997). San Diego: Singular Publishing Group, Inc.

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Ross, M., Brackett, D. & Maxon, A. (1991). Communication Assessment. In *Assessment and management of mainstreamed hearing-impaired children* (pp 113–127). Austin, Tx: Pro-Ed.

Ying, E. (1990). Speech and Language Assessment: Communication Evaluation. In M. Ross (Ed.), *Hearing-impaired children in the mainstream* (pp 45–60). Parkton, MD: York Press.

THE FUNCTIONAL LISTENING EVALUATION

Name:_____ Date:_____ Examiner:_____ Age/DOB:_____

AUDIOMETRIC RESULTS

Hearing Sensitivity: Pure Tone Ave: Right Ear_____dB   Left Ear_____dB

PTA used: ☐ 500, 1K, 2K   ☐ 1K, 2K, 4K

Word Recognition: Right Ear_____% @ ___dBHL   Left Ear_____% @ ___dBHL

Sound Field: Aided ☐   Unaided ☐

Quiet _____% @ _____dBHL

Noise _____% @ _____dBHL @ _____S/N

INTERPRETATION MATRIX

Noise

	quiet	noise
close-aud	2	4
close-aud/vis	1	3
distant-aud	7	6
distant-aud/vis	8	5

Distance

	close	distant
quiet-aud	2	7
quiet-aud-vis	1	8
noise-aud	4	6
noise-aud/vis	3	5

Visual Input

	aud-vis	aud
close-quiet	1	2
close-noise	3	4
distant-noise	5	6
distant-quiet	8	7

Average scores: _____% _____%   _____% _____%   _____% _____%
                   quiet noise   close distant   aud/vis aud

With Hearing Assistance Technology :
Average scores: _____% _____%   _____% _____%   _____% _____%
                   quiet noise   close distant   aud/vis aud

FUNCTIONAL LISTENING EVALUATION CONDITIONS

Amplification: ☐ None ☐ Hearing Aid(s) ☐ Cochlear Implant(s)
                 ☐ Bone- conduction device

Hearing Assistance Technology: ☐ Personal FM ☐ Classroom
                 ☐ Other_____

Classroom Noise Level: Unoccupied _____dBA SPL; Occupied _____dBA SPL

Assessment Material: _____

Distance (distant condition): ___ft

Noise Stimulus: ☐ Multitalker ☐ Classroom ☐ Other_____

Speech level @ listener's ear: ____dBA SPL ; @ 1 ft from examiner: ____dBA SPL

Noise level @ listener's ear: ____dBA SPL

Approximate speech to noise levels: close +____dB   distant -____dB

Modifications in protocol:

INTERPRETATION AND RECOMMENDATION

FUNCTIONAL LISTENING SCOREBOX

	close/quiet	close/noise	distant/quiet	distant/noise
auditory-visual	1	3	8	5
auditory	2	4	7	6

Revised 2011 by C.D. Johnson. Based on Functional Listening Evaluation by C.D. Johnson & P. Von Almen, 1993.