

# THE FUNCTIONAL LISTENING EVALUATION<sup>1</sup>

## Modified for Virtual Administration<sup>2</sup>

### Purpose of the Functional Listening Evaluation (FLE)

The purpose of the FLE is to determine how listening abilities are affected by noise, distance, and visual access in a student's everyday 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 representative of typical classrooms and other settings than cannot readily 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 with the addition of hearing assistance technology such as a remote microphone (RM) system, the evaluation results provide evidence of the benefits of the device in enhancing access to the desired input. The format of the FLE may also be useful in justifying other accommodations, such as sign language or oral interpreting, note-taking, 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).

For use in a virtual online environment, the FLE can be used to assess how the variables of background noise, visual access, and internet speech transmission quality impacts understanding of the teacher's voice during remote instruction. The FLE can also be used to compare performance under various conditions including personal hearing instruments, headphones and/or remote microphone hearing assistance technology. The FLE can also be used to demonstrate effects of various face masks.

### Materials Needed for Virtual Presentation

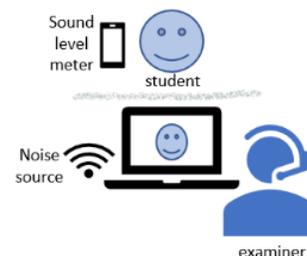
- CD player, iPad, phone or laptop computer to play noise source
- Sound Level Meter or SLM App - use A weighted scale on SLM at student's location
- Headset microphone connected to computer for examiner
- Classroom noise source (.wav sound file, classroom noise or multi-talker noise is recommended)
- Word/Phrase/Sentence Lists for test stimuli

### Environment for Testing

The learning environment is the location where the student is participating in online classroom instruction – typically a room in their home, the library, or a community location.

### Physical Set-up of Test Environment

The virtual version of the FLE is designed for the close distance where the teacher and student are in separate locations communicating via an internet video and audio application. Other virtual classroom instruction arrangements could result in a distance setting if the teacher is at a distance from the computer microphone such as may occur if the teacher is teaching from his/her classroom. Should this distance situation occur, it can be assessed using the same format as the close arrangement. The examiner should use a headset to eliminate ambient noise and provide the best signal clarity.



### Types of Evaluation Materials

In order to simulate classroom listening ability, the speech evaluation material utilized should be developmentally appropriate and approximate material that is encountered by the student in the classroom. Additionally, the stimuli should have enough 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. Students with unilateral and mild hearing losses tend to perform well under all

<sup>1</sup> Based on Functional Listening Evaluation by C.D. Johnson & P. Von Almen, 1993; Updated 2013 by C.D. Johnson

<sup>2</sup> 11.19.20. Available from [www.ADEvantage.com](http://www.ADEvantage.com)

conditions due to the audibility and inherent redundancy in phrase and sentence material utilizing familiar vocabulary. Nonsense phrases have been constructed to increase listening difficulty.

Age, language competency, 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 level. 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 Summary and Interpretation Form. Common materials include are listed below. In many of these materials there will not be sufficient lists if all eight conditions 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 of twenty phrases and provide the option of phrase or word scoring.

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

Note: The Common Children's Phrases and Nonsense Phrases are at the author's website: [www.ADEvantage.com](http://www.ADEvantage.com); other word and sentence lists should be available from most pediatric and educational audiologists.

The *Recorded Functional Listening Evaluation Using Sentences* (Johnson & Anderson, 2013) is available on CD from <https://successforkidswithhearingloss.com>. This version utilizes 5-word HINT-C (Hearing in Noise Test for Children) sentences that were based on the original Bamford-Kowal-Bench (BKB) sentences (1979). Half of the sentences are recorded in quiet and the other half with a +5 SNR (signal-to-noise ratio) and follow the condition presentation order of the FLE. This version simplifies presentation of the FLE by eliminating the need for a noise file and adjusting noise and speech sound levels; however, the SNR cannot be altered, and modifications need to be made for the auditory/visual mode. Additional instructions are provided with the CD.

### Presentation Levels

The auditory and auditory/auditory-visual modes are presented in quiet (2 presentations) and then in noise (2 presentations) to achieve the four conditions. Sound level measurements of the student's environment and the examiner's voice levels are necessary to achieve +5 dB speech advantage for quiet and a -5 dB speech level for noise. The SLM app should be downloaded to the student's phone or other device prior to administering this procedure. These procedures are:

1. Room Noise Level: Using a sound level meter phone app, guide the student, or other assistant at the student's location, to measure the noise level within approximately 1 foot from the student's ear. Record level under FLE Conditions on the summary form.
2. Calibrate the examiner's voice level: While the examiner is reading a short passage, ask the student or assistant to adjust the volume of the device that they are using for instruction (e.g., computer, notebook) to a comfortable listening level. Using the sound level meter phone app, ask the student or assistant to measure the level of the voice signal within 1 foot of their ear. This computer or device volume level must be maintained throughout the assessment. Record the level under FLE Conditions on the summary form.
3. Speech-to Noise Ratio (SNR) Level: Record the speech level that is above the room noise level. For example, if the speech level was 60 dBA and the room noise level was 40 dBA, the SNR is +20dB. Record the level under FLE Conditions on the summary form.
4. Noise Source: Open the noise source on the examiner's computer or other device. For the noise conditions, adjust the volume of the noise source (classroom or multi-talker noise) while guiding the student or an assistant using the sound level meter app, so that the **noise level is 5 dB greater than the examiner's voice level** within 1 foot of the student's ear. This yields a -5 dB speech-to-noise ratio level. For example, if the examiner's voice level is 60dBA at the student's ear, the noise level should be adjusted to measure 65 dBA at the student's ear. If -5 dB is too difficult, the noise level may be reduced so that the voice level and noise are at the same level (0 dB SNR).

## Presentation Protocol

The first four conditions of the FLE should be conducted in the student's typical hearing mode, e.g., no hearing aids, with hearing aids, cochlear implant or Baha. When this evaluation is also used to evaluate other accommodations (e.g., headset, remote microphone system), the examiner should use the optional conditions (5-8) to demonstrate the impact of the technology or accommodation.

Basic Conditions with student's personal hearing instrument:

1. Auditory-Visual: Quiet (examiner using headset mic with student facing examiner for visual access)
2. Auditory: Quiet (examiner using headset mic with camera off to eliminate visual access)
3. Auditory-Visual: Noise (same as condition 1 with the addition of noise)
4. Auditory: Noise (same as condition 2 with the addition of noise)

Optional Conditions (5-8): For student - add headphones, add RM HAT system; For examiner: add facemask, add RM system, remove headset microphone; or other modification or condition as desired. Note the conditions on the Scorebox.

When presenting the FLE via live voice, the examiner should present the speech materials at a normal speaking rate while maintaining a consistent volume. Instruct the student to repeat the speech stimuli or point to the appropriate picture, as indicated by the material used. Depending on the number of conditions, test administration takes approximately 15-20 minutes, including set up. For the auditory only conditions, it is recommended that the examiner turn off their video camera or instruct the student to look down. Placing a hand or paper in front of the talker's mouth will change the acoustic characteristics of the speech sounds.

## Scoring

Scoring should be completed using the established procedures for the selected test material. Although scoring may be made on either total phrase/sentence correct or by number of words correct, total phrase/sentence is recommended. All scores should be reported in percent correct in the Scorebox on the Summary and then transferred to the Interpretation Matrix.

## Interpretation Matrix

The Interpretation Matrix analyzes the effects of noise and visual input. It is completed by transferring the percentage correct scores from the Scorebox to the same numbered box in the Interpretation Matrix. Individual scores are summed and averaged to determine the overall effect of each condition. Although scores may be affected by different speakers, rate of speaking, attention of the listener, or status of amplification, **comparisons are valid if these variables are kept constant throughout the evaluation.**

Students with normal hearing levels typically perform at 90% or above even in background noise. Generally, the easiest condition is the auditory-visual mode in quiet. When validating RM hearing assistance technology or other accommodation, the target for desired performance is the score from box 1 (for auditory visual) or box 2 (auditory only) of the Scorebox. In other words, the effects of noise and distance can be considered eliminated when the performance with the technology matches the individual's best performance in quiet, or at least 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 communication access options. A summary of the Interpretation Matrix and appropriate recommendations should be written on the scoring form.

## References

- Johnson, C.D. (2021). Common Children's Phrases, Children's Nonsense Phrases, In *Educational Audiology Handbook* (3rd Ed.) (150-154). San Diego: Plural Publishing Inc.
- Johnson, C.D. (2013). *Functional Listening Evaluation*. Available from [www.ADEvantage.com](http://www.ADEvantage.com)
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- Ross, M., Brackett, D. & Maxon, A. (1991). Communication Assessment. In *Assessment and management of mainstreamed hearing-impaired children* (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* (45-60). Parkton, MD: York Press.

# THE FUNCTIONAL LISTENING EVALUATION: SUMMARY FORM

## Modified for Virtual Administration

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Examiner: \_\_\_\_\_ Age/DOB: \_\_\_\_\_ Grade: \_\_\_\_\_

### AUDIOMETRIC RESULTS

Hearing Sensitivity: Pure Tone Ave: Right Ear \_\_\_ dB Left Ear \_\_\_ dB  
 Word Recognition: Right Ear \_\_\_% @ \_\_\_dBHL Left Ear \_\_\_% @ \_\_\_dBHL  
 Sound Field: Aided  Unaided   
 Quiet \_\_\_% @ \_\_\_dBHL  
 Noise \_\_\_% @ \_\_\_dBHL @ \_\_\_ S/N

### FUNCTIONAL LISTENING EVALUATION CONDITIONS

Amplification:  None  Hearing Aid(s)  Cochlear Implant(s)  
 Bone- conduction device  
 Hearing Assistance Technology:  RM DM/FM system Other \_\_\_\_\_  
 Headphones  Other \_\_\_\_\_  
 Assessment Material: \_\_\_\_\_  
 Noise Stimulus:  Multi-talker  Classroom noise  Other \_\_\_\_\_  
 Noise level @ listener's ear: \_\_\_ dBA SPL  
 Speech level @ listener's ear: \_\_\_ dBA SPL (without HAT or headphones)  
 Approximate speech to noise level (SNR): \_\_\_ dB  
 Other modifications in protocol: \_\_\_\_\_

### INTERPRETATION MATRIX

|                 |       | Noise         |               | Visual Input |                 | Other:          |             |
|-----------------|-------|---------------|---------------|--------------|-----------------|-----------------|-------------|
|                 |       | quiet         | noise         | aud          | Aud/vis         | aud-vis         | aud         |
| aud/vis         | quiet | 1             | 3             | 2            | 1               | 5               | 6           |
|                 | noise | 2             | 4             | 4            | 3               | 7               | 8           |
| Average scores: |       | ___%<br>quiet | ___%<br>noise | ___%<br>aud  | ___%<br>aud/vis | ___%<br>aud-vis | ___%<br>aud |

### INTERPRETATION AND RECOMMENDATIONS

### FUNCTIONAL LISTENING SCOREBOX

[Note condition here]

|                 |   | quiet | noise | _____ | _____ |
|-----------------|---|-------|-------|-------|-------|
| auditory-visual | 1 | 3     | 5     | 7     |       |
| auditory only   | 2 | 4     | 6     | 8     |       |

