Online Session 7

Aural Hab: Child

Karen L. Anderson, PhD
Supporting Success for Children with Hearing Loss

This Week's Learning Objectives
You will be able to …

1. Describe issues impacting speech perception and listening, especially in school settings
2. Discuss why some HAT devices are preferred over others for classroom listening
3. Describe different assistive devices that may be appropriate for use by children with hearing loss

Classroom acoustic conditions & listening

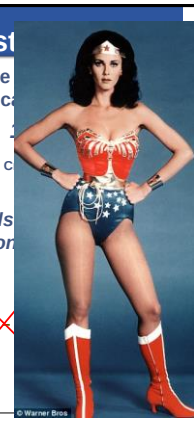
Dist

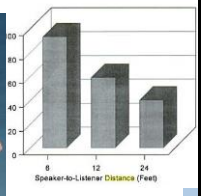
Effect of distance
recognition (typica

6 feet – 85%

24 feet – 44% c

Most hearing aids … nts are designed to work best at a cor… e of 3 – 6 feet

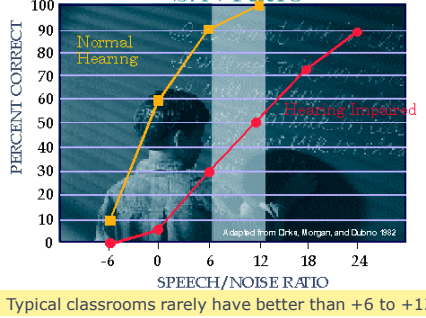




Analogy tool: Picking speech out of background noise

I see some beautiful flowers.	+20
Big dogs can be dangerous.	+15
I like to go to school.	+10
It is lunch time soon.	+5
Walk to the library now.	0
Your brother is not here.	-5

Speech discrimination scores as a function of S/N ratio



Typical classrooms rarely have better than +6 to +12 S/N

S/N + "little" hearing loss

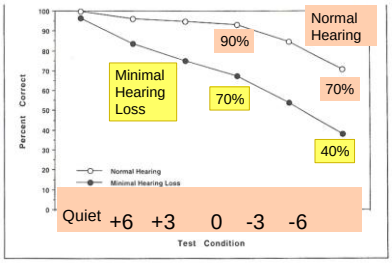


Figure 4–2. Mean sentential recognition scores, in percent correct, as a function of signal-to-noise ratio for children with normal hearing sensitivity (indicated by the open circles) and minimally hearing-impaired children (indicated by the closed circles). Figure adapted from Crandell, C. (1993). Speech recognition in noise by children with minimal hearing loss. *Ear & Hearing, 14*(3), 210–216.

Minimal hearing loss = 16-25 dB.

A fabulous HA fit or implant MAP!

Visual analogy of speech sounds smearing together as RT increases

I see some beautiful flowers.

Big dogs can be dangerous.

I like to go to school.

It is lunch time soon.

Your brother is not here.

Walk to the library now.

I want pancakes and ice cream with

Increasing Reverberation Time

RT + "little" hearing loss

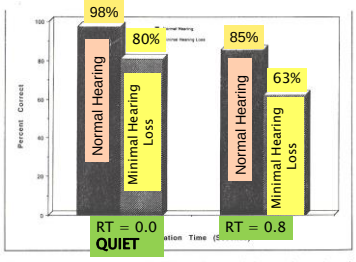


Figure 4–1. Speech perception of children with minimal degrees of sensorineural hearing loss (pure-tone thresholds from 15 to 30 dB from 500 to 2000 Hz) in a non-reverberant (T = 0.0 second) and reverberant (T = 0.8 second) listening condition. Adapted from Boney, S., & Bess, F. (1984). *Noise and reverberation effects in minimal bilateral sensorineural hearing loss.* Paper presented at The American Speech, Language, and Hearing Association Convention, San Francisco, CA.

Minimal hearing loss = 16-25 dB.

A fabulous HA fit or implant MAP!

Listening in a Sea of Noise

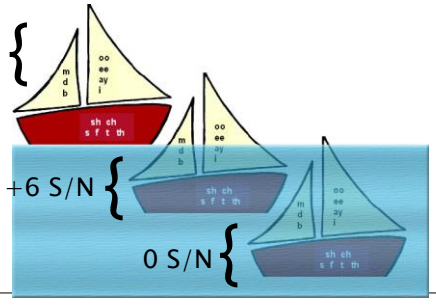
30 dB speech range (45–75 dB)

+15 S/N

NOISE typically 60 dB, can be same as loudness of teacher voice

+6 S/N

0 S/N



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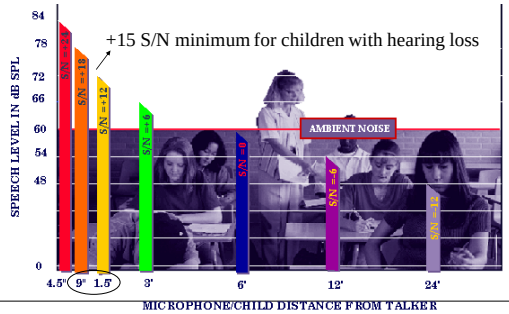
Effect of Distance on Speech Loudness over Noise (S/N)



Poor classroom acoustics = poor speech recognition, greater listening effort required

POOR CLASSROOM LISTENING ENVIRONMENT EFFECTS SUMMARY

- The newer or more difficult the task, the greater the chance for noise interference
- Speech or intermittent noise are more interfering than continuous noise
- More than a simple masking effect
- Greater effects occur for children with disabilities related to attention, reading, language, cognition, hearing loss, and ESOL
- Noise effects include: fatigue, distractibility, attention, reading, achievement, health

POOR CLASSROOM LISTENING ENVIRONMENT EFFECTS SUMMARY

- Noise and/or reverberation adversely impacts speech perception, more in children than adults
- Children up to age 13-15 are more adversely effected than adults
- Children do not habituate to learning in noise
- Adverse listening conditions are most detrimental when students are learning new/complex info
- Children educated in noisy conditions tend to give up easier (less persistent) than quiet school peers and are less flexible to changing conditions

POOR CLASSROOM LISTENING ENVIRONMENT EFFECTS SUMMARY

- Noise causes less attention to social cues
- Binaural listening is key to optimal performance in noise + reverberation
- Noise effects speech perception which appears to effect language process and auditory discrimination and subsequently impacts the development of reading skills
- All of these effects are greater if a child also has a hearing loss!

A-Z Challenges or Barriers when Listening to Learn

1. Hearing loss causes a reduced "listening bubble" that is improved by hearing aids or cochlear implants but normal hearing is not restored
2. Child misses some of the communication naturally occurring in their environment but beyond their "listening bubble"
3. The resulting gaps in language or world knowledge may be minimal to substantial
4. Speech may be perceived with some sounds missing (i.e. high frequency consonants)

A-Z Challenges or Barriers when Listening to Learn

5. Hearing aids or cochlear implants deliver speech at a quieter loudness than what is typically heard by persons with normal hearing

6. Ability to attend to verbal instruction varies over time with auditory and visual distractions, level of fatigue and interest

7. When the speech puzzle is incomplete and smeared, the high pitch rapid speech of classmates can be incompletely heard and peer relationships may be effected

8. Teacher vocal loudness, distance, and background noise change continuously

A-Z Challenges or Barriers when Listening to Learn

9. Acoustic energy of speech decreases the farther away the child is from the teacher

10. Background noise covers up quieter parts of speech

11. Reverberation affects clarity of the perception of speech by smearing sounds, adding noise due to prolonged sound reflections and shortening the critical distance for listening

12. When more effort is needed to perceive speech, less energy is available to meaningfully comprehend what has been said and achievement is affected

So what can we do about it?

How to make listening in a sea of noise more like a pond?

Address challenges within the child

1. Foster a workable understanding of the 'listening bubble' effects for all who teach or care for the child. Teacher in-service necessary!
2. Monitor skill development and classroom function a minimum of 2x/yr (i.e., SIFTERS, LIFE at www.hear2learn.com)
3. Work to head off predictable gaps in language growth – at home and at school
4. Optimally fit amplification/CIs with frequent audiology checks
   - -monthly for under age 1 year
   - -every 2 months from age 1 – 3 years
   - -every 6 months from 3 – 6 years and then annually thereafter

Address challenges in the learning environment

REDUCE BACKGROUND NOISE!!!

35 dBA average background noise level for unoccupied classrooms is the standard.

- The closer the ambient noise level is to 35 dB the easier it will be for students to hear one another and the teacher.
- For cooperative learning and group projects, it is important for children to hear not only the teacher, but also their peers.

HOW?

If listening is a primary gateway to learning then background noise puts bars on that gateway. An 'appropriate placement' includes an adequate listening environment

- If the HVAC system is too noisy it is expensive to replace it - you may have to consider another classroom or another school
- If sound comes through the classroom walls choose a classroom where this happens least and arrange seating so that children are away from the wall
- Keep classroom door closed (hallway noise)

HOW? ($)

- 4. Treat the noise offenders
  - Carpet hallways or put acoustic tile in halls
  - If spaces above ceiling tiles are shared between classrooms, insert acoustic baffles in the space
  - Carpet classroom floors to reduce child noise
  - Line ventilation ducts with acoustic materials or silencers
  - Acoustic panels placed on adjacent walls
  - Tennis balls on bottom of desk and chair legs

5. REDUCE REVERBERATION!!

0.6 seconds reverberation time is the standard

-increase absorptive materials in classroom

-good acoustic tile on ceiling (0.65 absorption coefficient or better)

-angle the bottom of white boards so that sound will be more effectively reflected to ceiling

-acoustic panels (1" minimum) on walls and/or carpet floor

-a bit of help in reducing RT can occur with curtains, bookshelves, mobiles, tapestry hangings

6. USE S/N ENHANCING TECHNOLOGY

Caveat – S/N technology will NOT address the need to reduce noise and reverberation levels.

Even with adequate acoustic conditions children with hearing loss will continue to need S/N technology to address listening across distance and noise interfering with the speech signal if they are to perceive the speech signal optimally.

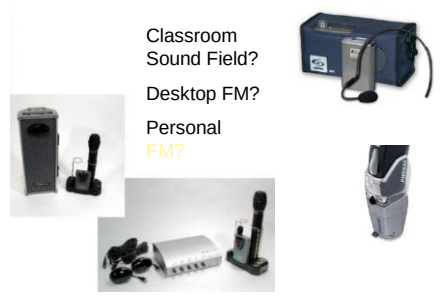
Using S/N enhancing technology in the Classroom

A necessity for access to verbal instruction

So what does the research say about S/N enhancing technology?

- Children with hearing loss benefit most from FM when in classrooms with good RT (0.3-0.4 RT)
- Even children with severe-profound loss can benefit from FM use, but there needs to be low RT, high S/N, and the child should have WDS ability better than 20% in quiet (babies too!)
- Soundfield can be beneficial in very low RT, but not as much as desktop or personal FM
- There is NO evidence indicating that children with hearing loss benefit from BOTH personal and sound field FM in the classroom

What type of S/N technology is best?



3 studies comparing 3 kinds of technology

- Who: In total, 28 children age 8-14, mild – profound loss, good language and academic skills,
- 22 with hearing aids, 6 with cochlear implant
- Children repeated 5-word HINT sentences
  - 15 lists of 10 sentences
  - 3 sentence lists per listening condition (3 FM conditions or HA/CI alone condition)
- Children completed 5 questions about FM preferences

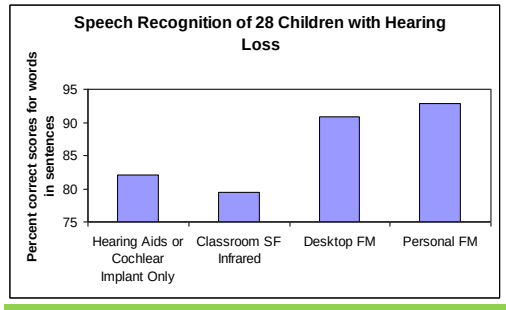
SUMMARY OF FINDINGS

1. Use of classroom sound field FM technology does NOT meet the listening needs of children with hearing aids or cochlear implants, even in relatively good classroom reverberation or noise levels (no significant difference)

2. Either desktop or personal FM is appropriate to meet the classroom listening needs of aided children (no significant difference)

Consistently presenting the signal within the critical listening distance is the key to optimal speech performance and academic performance!

Overall differences in performance at a glance….



Summary of 3 FM Study at:
https://successforkidswithhearingloss.com/resources-for-professionals/impact-on-listening-and-learning

Testimony

" The ceiling FM is like nothing. The desktop FM works well, but the personal FM works best."

Quote from participant, age 14

PERSONAL FM vs SOUNDFIELD

- **Benefit of FM over CI alone**

Personal DAI FM	38.0%
Desktop FM	17.1%
Soundfield FM	3.5%

- **Results should be similar for children using hearing aids and for children with APD.**
- Schafer, E and M Kleineck, 2009. Improvements in Speech Recognition Using Cochlear Implants and Three Types of FM Systems: A Meta-analytic Approach. J. Educ. Audiol, 15; 4-14.

Listening in a Sea of Noise: What can we do?

- **Control background noise to 35 dB or less**
- **Reduce RT to 0.6 seconds**
- **Use S/N technology that provides the speech signal within the critical listening distance**
- **Monitor child function in the classroom over time**

Make It Yours

A mother of a 7-year-old with hearing aids calls you. She just read in a chat room that kids should have both a personal FM and a sound field FM (CADS) system. She wants to know what you've heard.

Assistive Devices

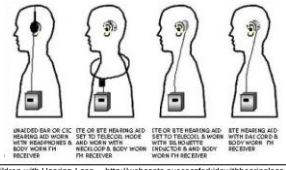
How Assistive Technology can help:

1. Face-to-face communication
2. Reception of electronic media
3. Telephone reception
4. Reception of important warning sounds and situations

Face-to-face communication & Reception of electronic media

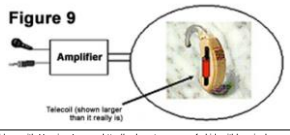
Auditory devices connecting directly into the sound source (computers, MP3, TV)

- Hardwired devices – uses cable to transmit sound. Needs a DAI connection, neckloop or silhouettes
- Wireless systems – transmitter + receiver



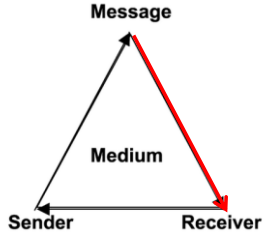
Face-to-face communication & Reception of electronic media

- **Loop Systems**
  - Becoming more common/popular in public areas
  - Uses in classrooms of multiple students with hearing devices
  - Requires good quality telecoils
  - Room-sized coil of wire converts the electrical energy to electromagnetic energy which is picked up by the telecoil circuit in the hearing aids.



Face-to-face communication & Reception of electronic media

- **Speech-to-Text Translation Tech/Service**



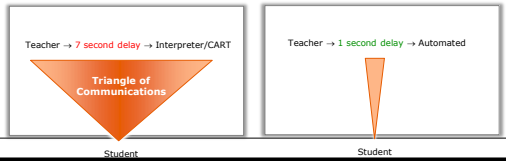
Continuum of Accommodations

- seating / speechreading
- FM / HAT (with any below)
- Note takers (with any below)
- speech-to-text captioning
- C-Print / Typewell
- CART
- iCommunicator: speech to text &/or video sign language
- sign language interpreter
- Interpreter + speech-to-text

Triangle of Communication

Goal is to minimize the triangle:

- Spatial Component: physical separation between the person generating the message and the interpretation.
- Temporal Component: the time delay between the message being generated and the message being received.
- Both are important, but Temporal is more important



Communication Access Realtime Translation - CART

- Provided by a trained court reporter
- Translation of the spoken word into English text using a stenotype machine, notebook computer and realtime software.
- Can project onto a screen or a computer
- Can be onsite or remote (needs internet and quiet classroom)
- CART certification requires 180 wpm with 96% accuracy
- Time delay to appear – 7-10 seconds
- Per hour fees vary - $75 - $140

C-Print

- Speech-to-text system developed and RIT
- C-Print captionist uses text-condensing strategies using an abbreviation system, which reduces keystrokes. Uses special computer software.
- Captionist – estimated training time 60 hours
  - Must type 60 wpm+
  - Ability to pay attention and 'condense' meaning
- Cost – 2 computers, software, training plus salary (What happens when the captionist calls in sick or decides to leave mid-year?)
- Pay about $15-$30/hour
- Consumer comments = C-Print is SLOW

Verbatim and C-Print Samples

VERBATIM SAMPLE	C-PRINT SAMPLE (meaning-for-meaning)
Well now, today class I want to talk about the topic, which is very interesting, of sexism in advertising - advertising that we see in magazines, on billboards, TV, and other places. Have you ever noticed, I'm sure you've noticed, you can't miss it, how women are exploited in the advertisements we see every day. In the manner of attractive, always attractive, beautiful women being used as props and adornments for men or products meant to appeal to men in advertisements.	Today I want to discuss the interesting topic of sexism in advertising. Have you noticed how women are exploited in advertising? Beautiful women are used as props and adornments for men or for products meant to appeal to men.

http://www.ntid.rit.edu/research/docs/YorkUniversityPresentation.pdf

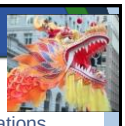
Typewell

- Originally developed as an improvement of C-Print.
- Transcriber uses a notebook computer with abbreviation software to transcribe what is said meaning for meaning in lectures and discussions.
- Students can also type questions and comments to the transcriber during class, and take their own notes on the reader computer.
- TypeWell transcribers provide students with a summary of information about both class content and social interaction.
- Capture speed is from 60 wpm to 100 wpm. Typical speed of speech is 100 – 180 wpm.
- Pay about $15-$30/hour

Caption Mic

- A person trains the Caption Mic system to recognize their voice.
- This voice captioner echoes or repeats what is being said at the live event or on the audio track.
- The voice captioner uses a mask microphone. The mask contains or silences the user's voice.
- The captions are displayed on the student's computer.
- Captioners typically perform at 95 to 98% accuracy.
- Caption Mic is self trained using computer prompts and the training materials. A person can train to be a voice captioner in a matter of days to weeks.
- Cost of software + mic = $4000 + computer

Dragon Naturally Speaking



- "Dragon is designed for dictation of documents; Interact-AS is designed for captioning conversations.
- It's kind of like having a screwdriver and a hammer. Both are very useful tools, but you need to use them in situations in which they're designed to be used. You could use a screw driver to pound a nail, but it won't work nearly as well as if you used the hammer.
- When you use Dragon to caption conversations, it works, but not as well as the tool that's designed for that task. Use Dragon to dictate documents; use Interact-AS to caption conversational free speech."

Robert Palmquist, CEO Speech Auditory Sciences

iCommunicator

Training for users recommended.
Uses Dragon Naturally Speaking 8.0 Professional software.
Price: $6500 + computer + $500 annual support

Interact-AS Speech-to-Text Translation

- Captions speech through the teacher's microphone.
- Also a speech generation device:
  - Voices aloud what a student types or writes.
- Save transcript as Word or Google doc
- Transcript includes a synchronized voice recording.

Interact-AS

☑ Configure on a Laptop

- Shown with the optional **FM Wireless Microphone System**.
- PC with **Intel i5 CPU** and **4 GB of RAM** is recommended.

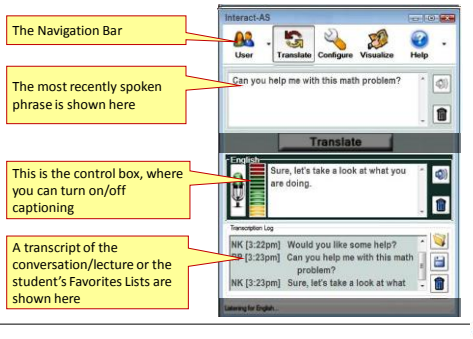
Interact-AS speech-to-text:

- **MUST use a boom microphone within about 1" of teacher's mouth (highest S/N possible needed)**
- **Can use a personal FM transmitter**
- **FM receiver needed so the computer can 'hear' the teacher**
- **FM receiver needs to be able to plug into computer – not all FM receivers are compatible**
  - Phonak MyLink+
  - Oticon Amigo Arc
  - Comfort Audio

- **You will need a 6" male-to-male cable for the FM to plug into the computer**
- **Standard Bluetooth lacks fidelity.**

A Quick Tour

Because the captioning happens so fast, the student can easily shift between the boxes.



Key issues when considering the need for visual accommodations

- **Language level** - how well would he understand if word-for-word was presented?
- **Reading fluency** – can he keep up?
- **Reading comprehension** – if he can keep up, can he understand similar to peers?
- **Distractibility** – how will he tolerate a triangle of communication?
- **Listening/speechreading** proficient enough to understand the majority – just needs a 'boost' when he misses a word or phrase?

Refer to Speech-to-Text Readiness Checklist

Assistive Listening Devices Detail

Assistive Listening Devices Detail

Cynthia Compton-Conley, Ph.D. - Gallaudet University, Washington, DC

Our Communication Needs

All of us share the following four communication needs:

- Face-to-face communication with other people
- Enjoyment of electronic media (radio, stereo system, television, the sound track at the movies, etc.)
- Telephone communication
- Awareness of environmental sounds and situations (doorbell, fire alarm, pager, etc.).

Facilitating Telephone Use

- **Telephone amplifiers & Captioned telephones**
- Florida Telecommunications Relay, Inc. (FTRI) is a statewide not-for-profit organization that administers the Specialized Telecommunications Equipment Distribution Program for citizens of Florida who are Deaf, Hard of Hearing, Deaf/Blind and Speech Impaired.
- The Florida Legislature passed the Telecommunications Access Systems Act (TASA) in 1991. The intent of TASA (F.S. 427) is to provide access terminals required for basic telecommunications services for Deaf, Hard of Hearing, Speech Impaired and Dual Sensory Impaired persons, in the most cost effective way.
- In response to TASA, the Florida Public Service Commission (FPSC) directed local exchange telephone companies to form a not-for-profit corporation to fulfill the TASA requirements. FTRI registered with the Florida Department of State as a not-for-profit corporation, effective June 13, 1991, and is a 501(c) (3) corporation.
- **http://www.ftri.org/**

Make it Yours!

Review the information on the following websites **http://www.fcc.gov/guides/telecommunications-relay-service-trs** and **http://www.ftri.org/**

A hearing family comes in with a longtime patient who is now age 10. He uses hearing aids, but is mainly a visual communicator. His speech is semi-intelligible.

He has some hearing friends at school and wants to be able to call them. He speaks to his friends but isn't sure if they will understand him. His hearing isn't good enough for him to understand over a typical phone, even with an amplifier.

What Telephone Relay Services would be reasonable options for this child's needs? Why? Could the family obtain something from FTRI that would meet the child's needs?

Alerting Devices

- Use either microphones or electrical connections to pick up the desired signal and hardwired or wireless transmission to send the signal in a form to which the person can respond.
- For example, when someone presses the doorbell button, when the phone rings or the fire alarm is activated, these events can trigger a flashing incandescent or fluorescent light, a loud horn, a vibrational device (pager, bed shaker), or a fan. Some systems use a combination of signals.

Children:

- Assistance in accessing alarm clocks
- Phones – set on vibrate

Alerting Devices

- **"Hear" the doorbell via vibration**
  The Detect Door doorbell and the wireless vibrator PocketVib work together to notify you when the doorbell rings. When visitors press the button on Detect Door, the signal is wirelessly transmitted to PocketVib which vibrates and lights up so that you are certain to be notified.
- PocketVib is wireless and can be carried around the home. Detect Door and PocketVib can be placed up to 75 meters apart. When the doorbell rings, PocketVib produces a powerful vibration and four LEDs are activated so you are certain to know when you have visitors.
  Be notified about other types of alerts
  When PocketVib is used in conjunction with the alert transmitters Detect and/or Observer, it can also provide notification in other situations, such as when: the telephone rings, the smoke alarm is activated, the baby cries, a bedridden person needs assistance

http://www.phonicear.com/ALD/Assistive_listening_devices/Doorbell_door_intercom/Puzzle_Detect_Door_PocketVib.aspx#close

Make it Yours!

The parents have completed the CHILD checklist and brought it in when they came with their 7-year-old with moderate-severe hearing loss. You notice that there are significant issues with the child getting up via a standard alarm clock. Although mom is very willing to wake her up every morning, it is important to foster children's independence.

What would you suggest?

Fast forward 8 years: She now wants to start babysitting but is afraid that families won't hire her because she can't hear the baby or children call from their bedrooms.

What would you suggest?

Preview for Next Week

FM Verification Lab

- **Watch the AAA DVD on FM Verification BEFORE you do the lab.**
- **Lab performed in pairs at a time you schedule with Sara**

- **Complete and submit the Measuring Acoustics Exercise by midnight Mar 29**