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Audiological Testing with Adults with Severe to Profound Hearing Loss, in partnership with RIT/National Technical Institute for the Deaf

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Disclosures

- **Presenter Disclosure**: Financial: Erin Pickett is an employee of RIT/NTID. Non-financial: Erin Pickett has no relevant non-financial relationships to disclose. Financial: Vanessa Murphy is an employee of RIT/NTID. Non-financial: Vanessa Murphy is a member of the Registry of Interpreters for the Deaf (RID).
- **Content Disclosure**: This learning event does not focus exclusively on any specific product or service.
- **Sponsor Disclosure**: This course is presented in partnership with the Rochester Institute of Technology/National Technical Institute for the Deaf.

Limitations/Risks

- The applicability and accuracy of the course content may vary by the clinical, geographical, and cultural context; you should evaluate the course accordingly.
- As healthcare is rapidly evolving, new findings may change the validity of the information presented in this course. Providers should always consult the latest research and guidelines from professional associations.
- The interventions discussed in this course may be limited in generalizability, requiring practitioners to consider specific individual and population factors.
- The course may not cover all possible risk factors, diagnostic methods, or treatment options, and complex cases may require additional considerations.
- Healthcare providers should apply cultural competence and sensitivity to ensure effective and respectful care based on their patients' diverse needs.
- Providers should always evaluate the limitations of diagnostic and screening tools, considering their potential for false results as well as any ethical implications.
- It is the responsibility of course participants to critically evaluate the evidence from multiple sources to guide professional practice.

Learning Outcomes

After this course, participants will be able to:

- List three case history topics you would highlight with the severe to profound adult population.
- List components of a possible test battery for this population.
- Describe three differences in test procedures for this population compared to a standard test battery.

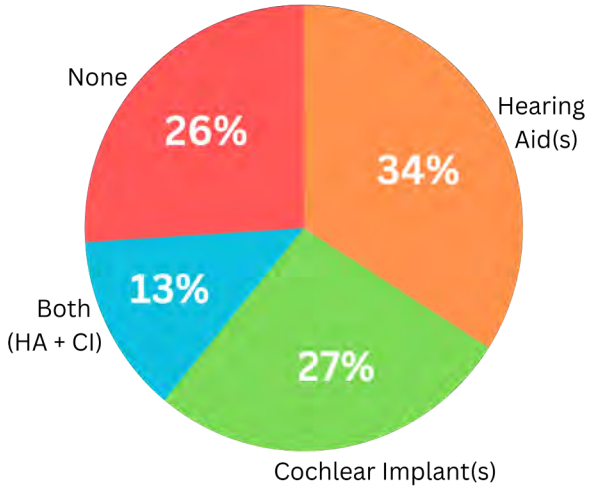
About NTID

The **National Technical Institute for the Deaf (NTID)** is one of the nine colleges of the **Rochester Institute of Technology (RIT)** in Rochester, New York.

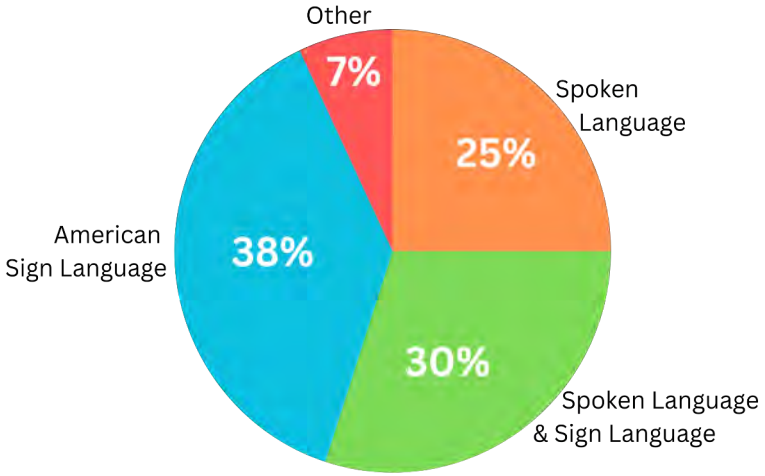
NTID was established by U.S. Congress in 1965 to provide higher education opportunities for deaf and hard-of-hearing students.

About NTID Students

Listening Technology Use



Communication Modes



About NTID AuDs & SLPs

- ASHA-certified Audiologists and Speech Language Pathologists at NTID provide on-campus audiological and speech-language services to members of the RIT and NTID Community. Our primary mission to serve and support the diverse communication needs and communication skill development for our deaf and hard of hearing college students.
- Our AuDs and SLPs are fluent in American Sign Language and prioritize matching each student and client's language and communication modalities.
- https://www.rit.edu/ntid/css/

Our Services

- **Audiology Center**
  - Hearing tests
  - Consultations
  - FM/Roger loans
  - Speechreading and/or listening training
  - Cochlear implant mapping
  - Hearing aid and cochlear implant adjustments, troubleshooting, repairs, and upgrades
- **Speech & Language Center**
  - Speech intelligibility
  - Grammar and technical/professional vocabulary and practice
  - Communication strategies for work-related interactions/job interviews
  - Presentation skill development and practice
  - Use of mobile applications as communication tools

Our Clinic

Population: Our main mission is to serve the deaf and hard of hearing students on campus. We see a large number of clients with severe to profound hearing loss (students, alumni, faculty/staff). As a result we've developed some procedures and protocols that may be useful for others who also work with this population.

Pre-appointment

Pre-Appointment

- Chart Review
- Set up communication aids/services prior to appointment
  - i.e., add question on clinic intake form & plan for accessibility services if needed

Required by law under the Americans with Disabilities Act of 1990

- it is the clinic's responsibility to provide effective communication with consideration of the client's preferred mode of communication

Communication Aids

- ASL interpreting, Video Remote Interpreting
  - Other questions about working with ASL interpreters? Refer to Continued course# 40519 “Working with ASL Interpreters”
    - Do’s and Don’ts of Working with ASL Interpreters Handout attached as a resource
- Captioning, speech-to-text apps
  - For more information about communication apps, check out the Continued presentation “Apps for Access: Bridging Deaf-Hearing Communication, in partnership with RIT/National Technical Institute for the Deaf” (Course # 42970)
- Notetakers, printed materials, visual aids

During Appointment

Considerations for the Severe-Profound Adult Population: Case History

During Appointment

RIT | National Technical Institute for the Deaf
Communication Studies and Services

Rochester Institute of Technology
52 Lomb Memorial Drive
Rochester, New York 14623
585-475-6473 (V), 585-469-2329 (T)
585-475-7910 (F), audiology@rit.edu

HISTORY

Date Completed:

Name:		DOB:	
Phone:		Email:	

Reason for appointment:

Have you had your hearing tested before?

- ☐ Yes If yes, where?
- ☐ No

Do you have known hearing loss?

- ☐ Yes If yes, explain onset and cause
- ☐ No

Do you have any of the following:

- ☐ Familial hearing loss
- ☐ Progressive hearing loss
- ☐ Noticeable change in hearing
- ☐ Deformity of the ear
- ☐ Ear pain
- ☐ Fullness/pressure in ear
- ☐ Hx of childhood ear infections
- ☐ Active ear infection/drainage
- ☐ Ear wax
- ☐ Surgery on ear(s)
- ☐ Tinnitus (ringing, roaring, etc)
- ☐ Dizziness
- ☐ Vertigo (room spinning)
- ☐ Noise exposure
- ☐ Allergies
- ☐ Current medication(s)
- ☐ Head injury
- ☐ High blood pressure

During Appointment

RIT National Technical Institute for the Deaf
Audiology Center

Lyndon Baines Johnson Hall
52 Lomb Memorial Drive
Rochester, New York 14623-5604

HEARING AID AND COCHLEAR IMPLANT (CI) HISTORY

Yes No

☐ ☐ Currently using a hearing aid
Ears
Age when first fit
Age of current hearing aids
Brand of current aids

☐ ☐ Currently using a CI/BAHA
Ears
Date of surgery(ies)
Age of current processor
Brand of implant

OTHER SERVICES

Yes No

☐ ☐ Interested in borrowing an FM system (students only)
☐ ☐ Interested in Auditory Training/Speechreading practice

HEARING CONSERVATION PROGRAM

Time since most recent noise exposure
Position/job at RIT (if applicable)
Length of time at position
Type of hearing protection used
Frequency of hearing protection use

Type of noise exposure (please check all that apply):

☐ Military service
☐ Firearms
☐ Power tools
☐ Loud music
☐ Motorcycles
☐ Heavy machinery
☐ Other (Explain)

Quiz Hint

Q2

Technology Use

- What device(s) are they using
  - hearing aid(s) (HAs), cochlear implant(s) (CIs), Bone Anchored Hearing Aid(s) (BAHA)
- When they started using technology
- Any periods of discontinued/intermittent use and why

Quiz Hint

Q2

Listening Goals

- Listening goals guide testing, programming, as well as counseling and recommendations
- Cultural sensitivity with this population and allowing their goals to guide treatment
  - e.g., deaf client may decide to use SP/UP hearing aids once a month to hear the environment

Listening Goals

- “I want to hear my dog bark”
- “I want to hear my baby cry”
- “I want to monitor my voice level while I talk”
- “I want to hear my video games”
- “I want to distinguish between /sh/ and /f/”
- “I want to be aware of sounds in my car”
- “I want to hear family during holidays”
- “I want to listen to music”

Quiz Hint

Q2

Language History and Preferences

- American Sign Language?
- English or other spoken language?
  - Both?
- Dependent on situation? (family vs. class/work vs. friends)
  - communication and reliance on hearing aids

Education History

Students

- Deaf school or mainstream education?
- What supports they used and if successful?

Case: Ed Continu

Case History

- Junior at RIT/NTID (age 21)
- Prefers ASL to communicate but does use spoken English with hearing people
- Longstanding history of severe to profound sensorineural hearing loss bilaterally since birth
- Family history of hearing loss, mom is deaf, dad is hard of hearing
- ID’d at 3 months old and fit with hearing aids at this time

Case History

- Attended mainstream school with a deaf program and received speech services
- Current hearing aids are Phonak Sky Marvel 90 UP BTE devices which were purchased in 2020
- Consistent hearing aid user

Case History

- Uses an ASL interpreter in his classes at RIT/NTID
- Listening Goals: “I want to communicate with hearing peers in the classroom, and I want to be able to communicate after graduation in the workplace. I also want to hear my video games and listen to music.”

Considerations for the Severe-Profound Adult Population: Assessment

Otoscopy & Immittance

Otoscopy

- As usual
- Consider using video otoscopy

Immittance

- Tympanometry as usual
- Absent acoustic reflexes

Ed's Results: Otoscopy & Immittance

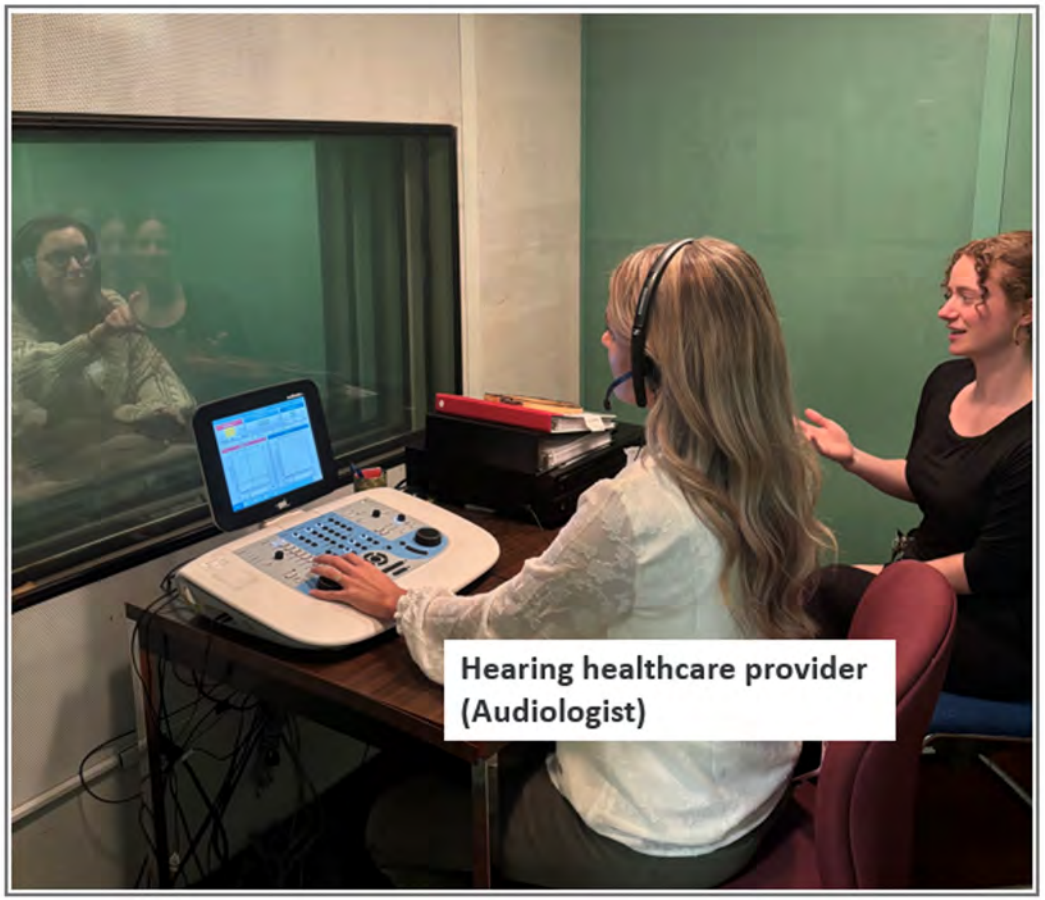
- Otoscopy: clear canals
- Tympanometry: Type A
- Reflex screening at 1000 Hz: absent

IMMITTANCE AUDIOMETRY		
	Right	Left
Canal Volume (cm^3)	2.0	1.8
Peak Pressure (daPa)	1	5
Peak Y (mmho)	1.2	1.4
Reflexes (Ipsi/Contralateral)		
	Right	Left
500 Hz		
(Screen) 1000 Hz	NR	NR
2000 Hz		
Decay		

Booth Testing

Booth Testing

deaf or hard of hearing patient



ASL interpreter

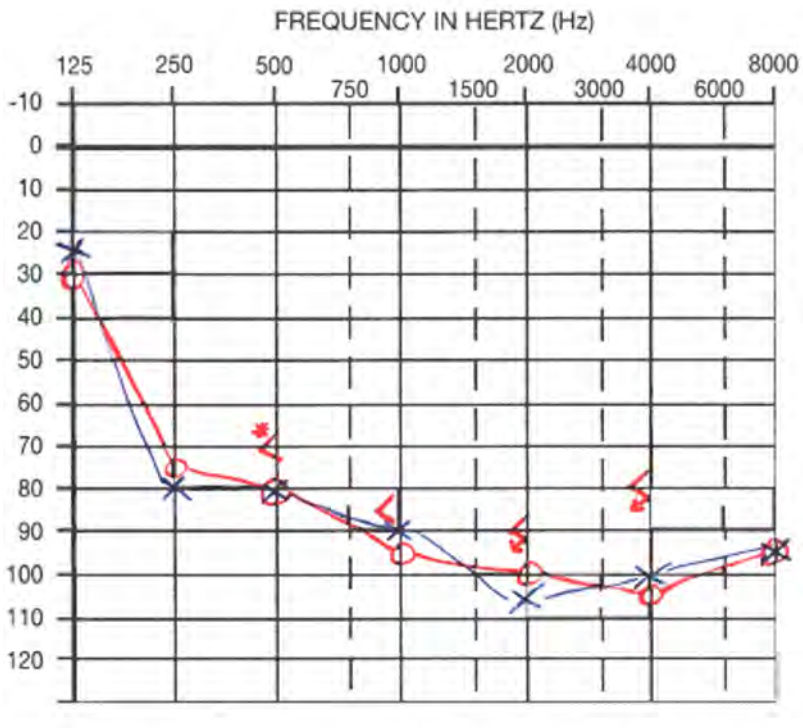
Quiz Hint

Q4

Pure Tone Audiometry

- Consider testing 125 Hz
  - Additional information
  - Hearing aid programming
  - Cochlear implant
    - Monitor residual hearing
    - Bimodal hearing aid
    - Acoustic stimulation
- Bone conduction
  - Expect vibrotactile in lows, possible no response in highs
    - Hearing vs. feeling

Ed Continu's Audiogram



Speech Testing

- Our philosophy
  - Document what clients CAN do, not only what they cannot
  - Avoid floor and ceiling effects
  - Create an affirming experience
- May discuss goals of speech testing
- May ask permission to do speech testing
  - Cultural sensitivity

Speech Testing

- SAT/SDT (spondees)
- 6-Select SRT
  - Smaller closed set of 6 spondees
  - Provide choices in writing
  - Recorded or MLV
  - Client can point to word, or interpreter can voice

BASEBALL	AIRPLANE	HOT DOG
PLAYGROUND	BIRTHDAY	COWBOY

- Regular SRT - provide written list for familiarization

Speech Testing

- SAT, 6-select SRT, regular SRT… where to start?
- Consider
  - client's audiological history and past results
  - communication with you during appointment
  - communication preferences and history
  - client's goals

Ed's Results

- We know he communicates with spoken language but prefers to use ASL
- Start with SAT
- Move to 6-select SRT

	RE	LE
SAT	65 dB HL	75 dB HL
6-SELECT SRT	90 dB HL	95 dB HL

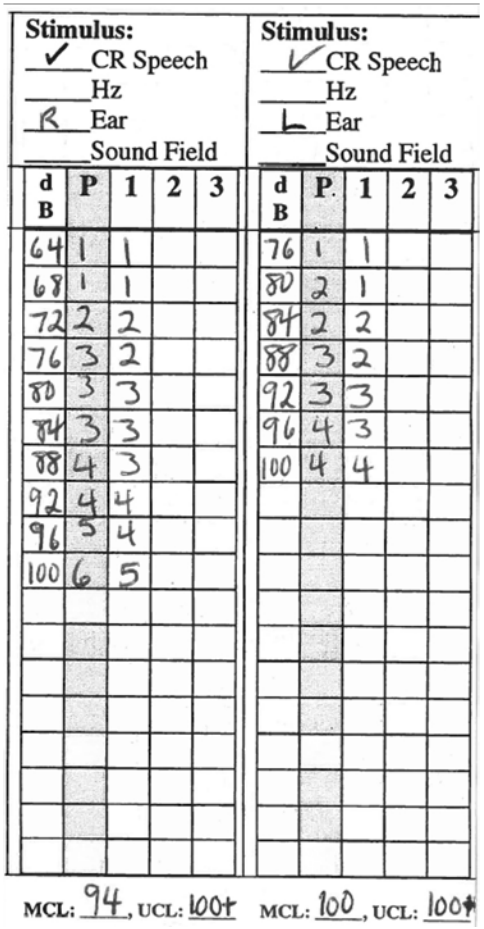
Speech Testing - MCL/UCL

- Traditional methods can be difficult with this population
  - Have narrow dynamic range
  - May not have reliable loudness perception
- Still important
  - To find MCL for speech testing
  - To aid with HA programming (e.g., is UCL lower than expected?)
  - For complete audiological evaluation (e.g., state laws, billing, etc.)

Speech Testing - MCL/UCL

- Loudness scaling with running speech stimulus (e.g., rainbow passage), adapted from Cox, 1995
- Rating scale
  1. Very soft
  2. Soft
  3. Comfortable but soft
  4. Comfortable
  5. Comfortable but slightly loud
  6. Loud but OK
  7. Uncomfortably loud
- Ascend in 2 or 4 dB steps

Ed's Results



Stimulus: ✓ CR Speech, ___ Hz, R Ear, ___ Sound Field					Stimulus: ✓ CR Speech, ___ Hz, L Ear, ___ Sound Field				
dB	P	1	2	3	dB	P	1	2	3
64	1	1			76	1	1		
68	1	1			80	2	1		
72	2	2			84	2	2		
76	3	2			88	3	2		
80	3	3			92	3	3		
84	3	3			96	4	3		
88	4	3			100	4	4		
92	4	4							
96	5	4							
100	6	5							

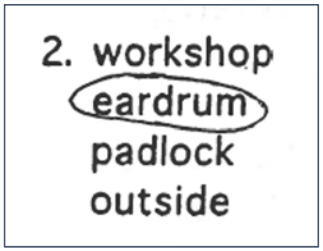
MCL: 94, UCL: 100+ MCL: 100, UCL: 100+

Quiz Hint

Q3

Speech Testing - Closed Set Tests

- Four-Choice Spondee Test
  - Included in the Minimal Auditory Capabilities (MAC)© battery
  - 3 recorded lists
  - Example item: “Ready? Eardrum”



  - Relies more on vowel recognition than consonant
    - Sev-prof population tends to have stronger vowel perception than consonant perception (Flynn et al., 1998)
  - Chance Score: 25%
  - 80% or greater (16+ correct) - may attempt sentence testing

Ed's Results

- Four-Choice Spondee Test
- Presented at equipment limits

	RE	LE
MCL	94 dB HL	100 dB HL
4-CHOICE @ 100 dB HL	100%, 20/20	85%, 17/20

Quiz Hint

Q1, Q5

Sentence Testing

- Our hierarchy of less to more difficult:
- CID Everyday Sentences
  - Included in the Minimal Auditory Capabilities (MAC)© battery (Auditec)
  - e.g., “Here we go”
- HINT
  - Presented in quiet
  - e.g., “The cat jumped over the fence”
- AzBio
  - Two female and two male talkers
  - e.g., “She wanted to follow in his footsteps”

Word/Sentence Testing and Interpreting

- Closed set speech testing (6 SELECT SRT): Recall client can point to word or interpreter can voice
  - provide interpreter and client with word list
- Open set word & sentence testing
  - provide client with paper to write answers
    - instruct client to write word-for-word what they hear
  - avoid using interpreter for this portion due to nature of test

Sentence Testing

- Consider aided testing
  - If “equipment limits” are below the client’s MCL, try aided speech testing
- Consider using MLV if recorded is too difficult
- Consider testing with visual cues
  - Some clients may have limited auditory-only speech recognition but benefit significantly from adding visual cues (Ceuleers et al., 2024).
  - Can use MLV through booth window or sit down face-to-face
  - Consider comparing auditory-only, auditory+visual, and visual only (e.g. unaided)

Quiz Hint

Speech Testing – Examples (adding visual cues)

- Case 1, CID Everyday Sentences
  - Listening only (with CI): 0%
  - Speechreading only: 58%
  - Listening + speechreading: 72%
- Case 2, CID Everyday Sentences
  - Listening only (with HA): 0%
  - Speechreading only: 64%
  - Listening + speechreading: 60%

- NTID Speechreading Test - available through Auditec

Ed's Results

- Speech Recognition Testing

Unaided

- W-22 @ 100 dB HL = 0%
- HINT @ 100 dB HL = 0%

Aided

- CID Everyday Sentences @ 58 dB HL = 26%

Note on Word Recognition Testing

It is rare we complete WRS testing (e.g., W-22) on this population, with some exceptions.

1. Excellent sentence recognition
2. Greater reliance on spoken language communication
3. As a required test (e.g., proof of deafness)

What's next for Ed?

CID Everyday Sentences with

1. Speechreading only
2. Listening + speechreading
    a) Real world functioning, listening goal: "I want to communicate with hearing peers in the classroom and in the workforce"

- Future HA verification
- Monitoring speech recognition to track hearing over time

Summary

We recognize…

- Clinic time is limited.

- How to prioritize?
  - If we do not have a clear idea where to start with speech testing, we prioritize the Four Choice Spondee Test to optimize chances for some success and to get info for where to go next
  - Consider client's goals (is speech testing even a priority?)

Summary of Testing Tips

- Use supra-aural headphones
- Test 125 Hz
- 6 SELECT SRT
- Loudness Scaling for MCL/UCL
- Closed set speech recognition testing i.e. Four Choice Spondee Test
- CID Everyday Sentences
- (Aided) sentence testing with visual cues

Resource

- For additional information on working with the severe-to-profound population, see “Guidelines for Best Practice in the Audiological Management of Adults with Severe and Profound Hearing Loss” (Turton et al., 2020) - available on ASHA website (especially for acquired hearing loss)

Outcomes

- Can also use these measures and strategies to verify HA and CI programming

- For more information on measures of success with this population, see ”Measuring What Matters: Success with Hearing Aids and Cochlear Implants for Adults with Severe-to-Profound Hearing Loss”

Thank you!

Erin Pickett, AuD, CCC-A/SLP
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RIT | National Technical Institute for the Deaf

Survey: Please provide feedback

A secondary mission of RIT/NTID is preparing professionals to work with the deaf/hard of hearing population. Your completion of this 5-question survey will help us monitor our impact and bring you the content you want and need!

Course Title: Enhancing Access: Classroom Acoustics & Assistive Listening Technology for DHH Students

Survey Link:
https://rit.az1.qualtrics.com/jfe/form/SV_3jSsLz8ViyPZDsq

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