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Enhancing Access: Classroom Acoustics & Assistive Listening Technology for DHH Students, in partnership with RIT/National Technical Institute for the Deaf

Carly Alicea, AuD, PhD, CCC-A



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Carly Alicea is a clinical audiologist in the Department of Communication Studies and Services at Rochester Institute of Technology/National Technical Institute for the Deaf (RIT/NTID). She provides a full range of diagnostic and rehabilitative services to RIT/NTID students, faculty, staff, and dependents.

Dr. Alicea also serves as a member of the department's committee on continuing education, planning, coordinating, and teaching continuing education workshops for other audiologists and speech-language pathologists at and outside the institute. Additionally, she has worked as an assistant professor teaching courses in speech-language pathology and audiology and at a non-profit speech and hearing clinic serving children and adults from a diverse array of backgrounds.

Disclosure

- **Presenter Disclosure:** Financial: Carly Alicea is an employee of Rochester Institute of Technology's National Technical Institute for the Deaf. Non-financial: Carly Alicea has no relevant non-financial relationships to disclose.
- **Content Disclosure:** This learning event does not focus exclusively on any specific product or service.
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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:

- Identify key factors that influence classroom acoustics.
- Describe the impact of poor acoustics on DHH students.
- List at least five different types of modifications or technologies that can assist DHH students with listening in the classroom.



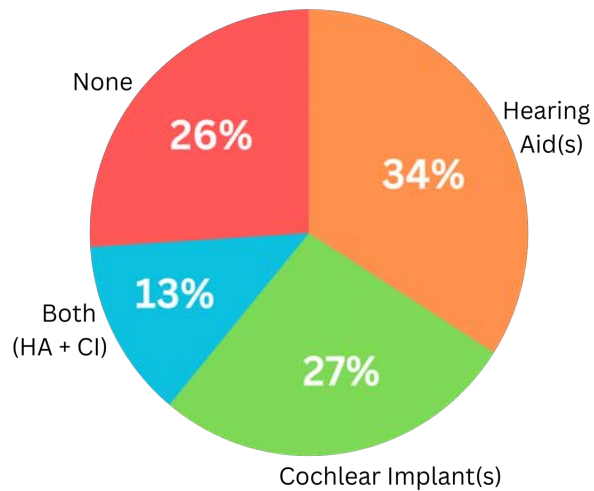
About NTID

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.

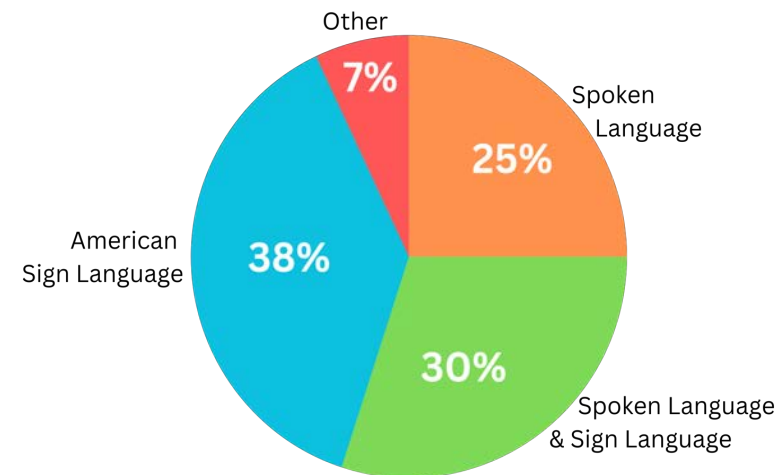
NTID was established by U.S. Congress in 1965 to provide higher education opportunities for deaf and hard-of-hearing students.

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.

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

Classroom Acoustics: The Hidden Barrier

Why Does This Matter?

- Good classroom acoustics benefit *all* children *and* their teachers
- Classrooms should be free of excessive noise and reverberation to achieve positive educational outcomes and effective communication
- Classroom listening environments should let children focus on *thinking and learning*, not *trying to listen*

Children in Noise vs. Adults in Noise

- Typically hearing adults are mature and skillful listeners
 - Can rely on language and life experience to assist with auditory closure and understand speech in sub-optimal conditions
- Children (and people with hearing loss) are more adversely affected by noise and reverberation
 - Auditory system is not fully developed until adolescence
- Children perform more poorly than adults on complex listening tasks (i.e., understanding speech in noisy or reverberant rooms)

Who Is At Risk In a Noisy Classroom?

- Young students (<15 years old)
- Students w/ hearing loss (all types and degrees, even minimal/mild)
- Students with auditory processing disorder (APD)
- Students with auditory neuropathy
- Students with acute or recurrent ear infections
- Students with language disorders
- Students with language disabilities, developmental delays, or ADD/ADHD
- English language learners (ELLs)

Factors That Impact the Acoustics in a Classroom

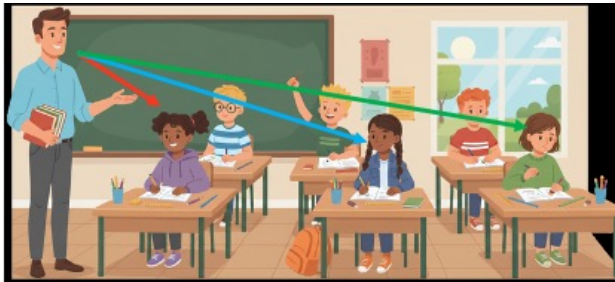
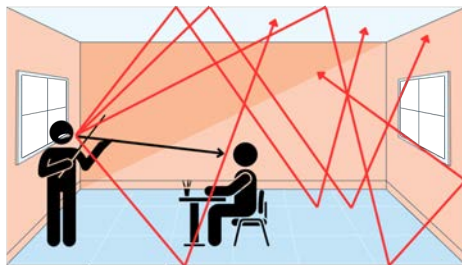


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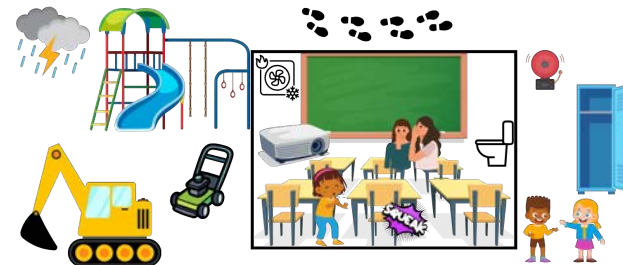
Distance



Directionality



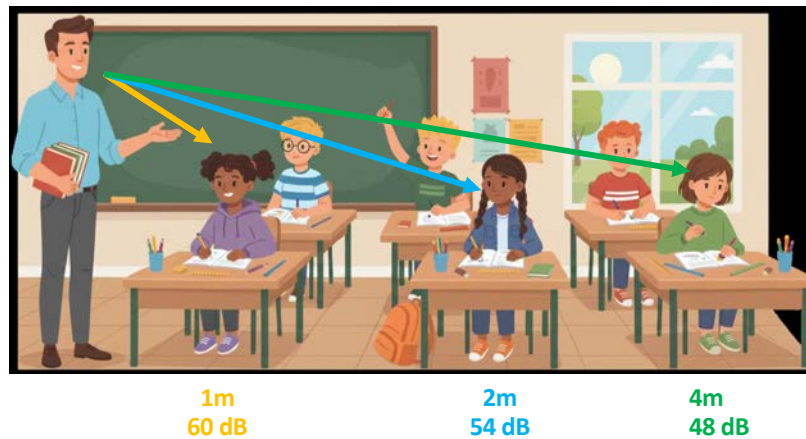
Reverberation



Noise

Distance

- Inverse Square Law → sound intensity decreases with distance from the source
 - For every doubling of distance, sound pressure level decreases by ~6 dB

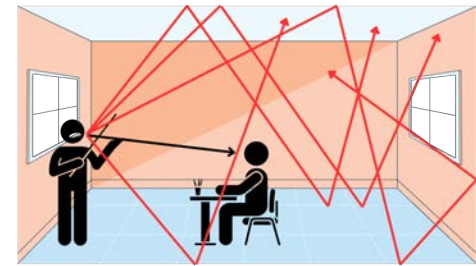


Directionality



Reverberation

- Reverberation is the persistence of sound after its produced
- Results from sound reflecting on surfaces in an enclosed space
 - Early reflections provide benefit
 - Late reflections can be detrimental
- Reverberation time (RT60) = amount of time it takes for the sound level to decay by 60 dB after onset
 - In rooms with longer RT60 times, speech perception is negatively impacted and learning may be affected

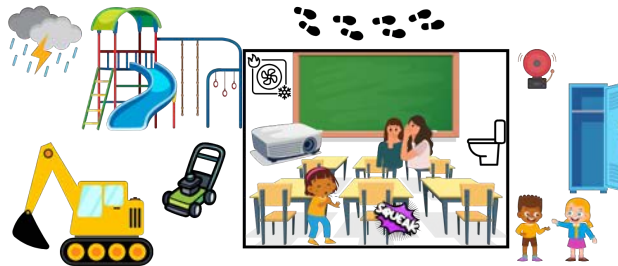


Noise

- Any unwanted sound that interferes with what the listener wants/needs to hear
- In a classroom, noise can be internal or external

- Signal-to-Noise Ratio (SNR)

- +15 dB SNR is the goal
- A higher SNR may be needed for students with hearing loss, APD, ENL learners, etc.



Impacts

- Reduced speech intelligibility
- Increased listening fatigue
- Reduced learning
- Poorer behavior
- ***Remember, some students will be more at risk/affected than others***

Standards & Strategies for Better Classroom Acoustics

Classroom Acoustics Standards

- Two published standards exist for classroom acoustics
 - ANSI/ASA S12.60/Part 1-2010 (R2020) American National Standard Acoustical Performance Criteria, Design Requirements and Guidelines for Schools, Part 1: Permanent Schools
 - ANSI/ASA S12.60-2009/Part 2 (R2020) American National Standard Acoustical Performance Criteria, Design Requirements and Guidelines for Schools, Part 2: Relocatable Classroom Factors
- These standards are voluntary, unless required by a local or state code
- The greatest 1-hour average A-weighted background sound level in a furnished but unoccupied classroom should not exceed 35 dB
- Generally, RT60 should not exceed 0.6 seconds for average-sized classrooms
 - For children with hearing loss, RT60 should not exceed 0.3 seconds

Are Classrooms Quiet Enough?

- Many (most) classrooms don't meet the ANSI recommendations
- So, what can we do about it?
 - Physical modifications
 - Assistive listening technology
 - Sound field amplification
 - Aural habilitation/rehabilitation and training
 - Education and advocacy

Physical Modifications

- Ceilings
 - For high ceilings (>11 ft), add acoustical panels
 - Add suspended ceiling of sound-absorbing tiles
 - Replace existing ceiling tiles with better acoustical tiles
 - Suspend banners, flags, student artwork, plants, etc. from ceiling to reduce noise and reverberation (as allowed according to fire codes)

Physical Modifications

- Floors
 - Install carpeting or use area rugs throughout the room
 - Use pads beneath carpeting/rugs
- Walls, Windows, and Doors
 - Add soft materials to walls like carpet or acoustical tiles
 - Cover walls with cork, felt, or flannel bulletin boards
 - Add curtains/draperies or acoustically treated blinds/shades
 - Install double-pane windows
 - Ensure doors are solid core and seal tightly

Physical Modifications

- Furniture
 - Stagger desks/chairs so that sound will not travel directly to hard reflective surfaces like walls, chalkboards, windows, etc.
 - Use felt/rubber caps (or tennis balls) on chair and table legs
 - Rearrange furniture so that instruction occurs away from noise sources
 - Place mobile bulletin boards and/or bookshelves at angles in in the corners
 - Cover table surfaces with fabric
 - Line study carrels with acoustic tiles
 - Install rubber pads beneath equipment to reduce noise in those areas

Assistive Listening Technology

Assistive Listening Technology

- Tech must be customized for the student's need and the classroom context
- Collaboration between audiologists, teachers, SLPs, and students is essential
- Deaf and hard of hearing students should be trained and empowered to use their tools
- Encourage regular equipment checks and listening environment evaluations

Classroom/School Listening Situations

- Share in the chat other listening situations that you can think of
- If you are watching this as a recording, how many different listening situations can you think of?

LISTENING SITUATIONS



TEACHER GIVING VERBAL
INSTRUCTIONS



STORY READ ALOUD



PEER PRESENTING A
PROJECT



WATCHING VIDEO/ AUDIO CLIP



SCIENCE LAB
INSTRUCTIONS



LEARNING NEW
VOCABULARY

There is no “one size fits all” solution to assistive listening technology in the classroom/school!

Types of Assistive Listening Tech

- **FM/DM Systems** (ex. Phonak Roger or Oticon EduMic) – teacher wears a microphone, signal is sent wirelessly to the students' hearing aids (HAs), cochlear implants (CIs), or receivers
- **Soundfield Amplification Systems** (ex. Phonak Roger DigiMaster, Lightspeed Redcat, etc.) – teacher wears a microphone and speaker system evenly distributes teacher's voice throughout the room for all students
- **Pass-Around Microphone** (ex. Phonak Roger Pass-Around Mic) - handheld microphone that teacher(s) or students can speak into, signal is sent wirelessly to receiver (in personal hearing device or speaker)

Types of Assistive Listening Tech

- **Bluetooth-Enabled Hearing Aids or Processors** (ex. many current HAs or CI processors) – connect directly to a laptop or tablet
- **Remote Microphones** (ex. ReSound/Cochlear MiniMic 2+, Phonak Partner Mic, Oticon ConnectClip) – manufacturer-specific microphones that transmit signal wirelessly to the students' HAs or CIs
- **Table Microphone Arrays** (ex. Phonak Roger Table Mic II) – pick up multiple talkers (i.e. sitting around a table) in a group work situation

Types of Assistive Listening Tech

- **Media Streaming Accessories** (ex. Roger Multimedia Hub) – connects to a range of multimedia devices (ex. computers, Smartboards, TVs, tablets) and streams audio to student's receiver

Choosing Classroom Listening Technology

- A student may need *more than one* type of technology
- Consider factors such as ...
 - Student's personal device(s) – HA? CI? Brand? Style? T-coil?
 - Listening situation(s)
 - Flexibility/portability
 - Ease/practicality of use
 - Other needs/disabilities?
 - *Student's preferences/willingness*

“Strategic” Seating

- You may have heard of “preferential seating” (usually means front row, etc.)
- Let’s replace that with “strategic” seating, which acknowledges that ...
 - Teaching and learning are dynamic
 - The front row is not always best
 - The “best” spot might look different across different parts of the day, different settings, different teachers, etc.
 - Different technology may be needed in different seating locations
- We must support students in learning to identify their own strategic seating, and in determining which technology is best suited for the situation

Case Study

Case Study

- “Frida”
- 8 years old
- Bilateral moderately-severe to severe conductive hearing loss
- Wears binaural Osia devices
- Also has a visual impairment – sees best if looking straight-on or to the left



Case Study

- 2nd grade ICT classroom at a suburban public school
- Class of 23 students, 2 teachers, 1 classroom aide
- Numerous students receive related services so additional teachers and therapists are in the room throughout the day
- Frida receives “push-in” services from TOD and TVI, as well as “pull-out” 1-on-1 services from SLP and small group reading support
- Attends 1-2 “Specials” class per day (art, music, technology, health, PE, library)

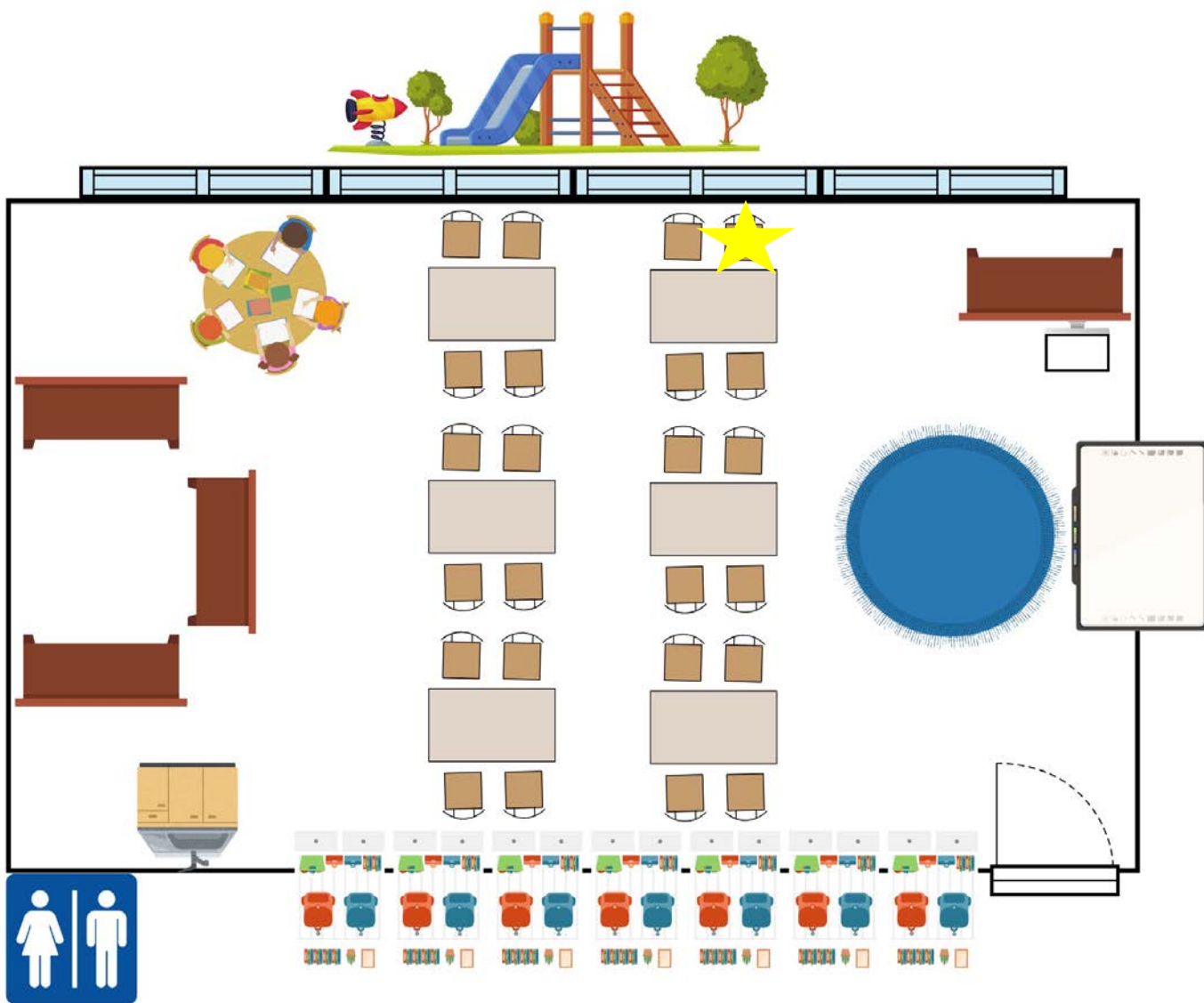


Image: Presenter Alicea

Case Study

- What are the potential challenges to listening and learning in Frida's classroom?
- Are there modifications to Frida's classroom that can be made to try to reduce some of these challenges?
- What assistive listening technologies might Frida benefit from in the classroom? What about in other settings across the school day?
- What might "strategic" seating look like for Frida?

Conclusions

- Distance, directionality, reverberation, and noise influence classroom acoustics and can make listening and learning difficult for DHH students
- Physical modifications to a classroom environment can help ameliorate some of these challenges
- There are also a variety of assistive listening technologies that can help, and there is no one size fits all solution
- Students should be supported and empowered to understand their own listening needs in the classroom and identify and utilize tools and strategies to manage those needs

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_3jSsLz8ViyPZDsqq



Thank you! Questions?

Carly Alicea, AuD,
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