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ACOUSTICS IN THE CLASSROOM

MSSE Master's Project

Submitted to the Faculty
Of the Master of Science Program in Secondary Education
Of Students who are Deaf or Hard of Hearing

National Technical Institute for the Deaf
ROCHESTER INSTITUTE OF TECHNOLOGY

By:

Carolyn Tully

Carolyn Tully

Student Signature

In Partial Fulfillment of the Requirements for the Degree of Master of Science

Rochester, New York

5-25-06 (date)

Approved: Josara Wallber
Project Advisor

Gerald Bateman
MSSE Program Director

Abstract

“Acoustics in the Classroom: a Guide for Classroom Teachers” is a brochure developed specifically for teachers of the deaf who work with mainstreamed deaf and hard of hearing students and their teachers. A review of the current literature, input from my experience as a Teacher of the Deaf, and veteran Teachers of the Deaf were used to generate the brochure. The goal is to evaluate and enhance acoustics in the classroom therefore enabling the use of residual hearing for spoken language learning. Noise as a health issue in general has been so well documented scientists have referred to the problem as “noise pollution.” With a higher number of deaf and hard of hearing students being educated in the mainstream, the goal for teachers is to enhance the classroom acoustics for the deaf and hard of hearing students by alleviating noise and by using strategies that give the students better access to the spoken signal. Research demonstrates these strategies will benefit not only deaf and hard of hearing students, but all children’s learning.

Project Overview

The project is an acoustics in the classroom brochure for teachers of mainstream deaf and hard of hearing students. The brochure contains ways to identify noise in the classroom and strategies to reduce the noise levels in the classroom.

The brochure can be copied and distributed to teachers who work with deaf or hard of hearing students during in-service training sessions and/or distributed for independent reading.

Importance of the Problem

The purpose of this project was to produce a brochure on acoustics in the classroom for teachers that have mainstreamed deaf and hard of hearing students. The brochure will help teachers become aware of noise and how disruptive it can be to all students, not only those with hearing loss and/or those using personal listening devices. Identifying noises and their sources will benefit all students in the classroom. My assistantship with Josara Wallber and the Audiology class she taught with Amanda Davis introduced noise as an educational problem. Later in my work as an itinerant student teacher I personally experienced the negative effects of noise on students using hearing aids and cochlear implants during the school day. These problems are generally not well recognized by classroom teachers.

Project Objectives

“Acoustics in the Classroom: a Guide for Classroom Teachers” brochure will help mainstream teachers identify both internal and external classroom noise and develop strategies for enhancing general classroom acoustics.

Review of Literature

Noise is a major health issue in today’s busy society, so much so that scientists study ‘noise pollution.’ Indeed, an entire issue of Environmental Health Perspectives, January 2005 was devoted to this very problem. People are busier than ever, and concomitantly, environmental noise has risen. Hearing loss is not the only effect of noise pollution. One author discusses several effects from noise exposure including: “elevated blood pressure, loss of sleep, increased heart rate, cardiovascular constriction, labored

breathing and changes in the brain chemistry.” (EHP, p. A38) The profound effect of noise on school aged children was demonstrated by one study conducted with sixth graders. The school was located near an elevated train track and the noise seriously affected the student’s ability to concentrate when reading. After the school installed acoustical tile on walls adjacent to the tracks, student reading scores improved. (EHP, p. A 39)

When a child has a hearing loss, these listening and learning effects are compounded. Missed information by a child with a hearing loss can lead to lower grades in school, making the child frustrated in class. Teachers who decrease the amount of noise and increase the volume of the intended signal in the classroom will ensure students are receiving information necessary to succeed. More and more deaf and hard of hearing students are being educated in the mainstream. In fact a 2000-2001 survey indicated that more than 75% of deaf and hard of hearing students are now educated in mainstream environments. This is a major change from 1975 when half of all deaf and hard of hearing students were “enrolled in residential or day schools for deaf students”. (Marschark, p. 23) Much of this change is a direct result of Public Law 94-142, now known as IDEA (Individuals with Disabilities Education Act).

The two main questions addressed in the educational literature are: 1) where is the disruptive noise coming from? and, 2) how is that noise effecting the students? Crandell and Smaldino (2000) discuss four different kinds of acoustic variables that are considered disruptive in a classroom. “The variables include the 1) level of the background noise, 2) level of the speech signal relative to the level of the background noise, 3) reverberation

time, and 4) distance from the speaker to the listener.” (p. 363)

Background noise is classified as either exterior noise such as a lawnmower, aircraft or automobile traffic, or internal noise; those generated inside the school hallways and rooms by equipment, building mechanics, and students themselves. Some examples include speech, chairs moving, computer printers, and/or ventilation ducts. Background noise in the classroom can affect all students’ ability to perceive speech, especially consonants. Research has shown that “even minimal decreases in consonant perception can significantly influence speech perception because the vast majority of a listener’s ability to understand speech is the result of consonantal energy.” (p. 364) Background noise not only impacts students but teachers as well. Results of more than 1,200 teachers indicated from one study that noise was associated with general teacher fatigue, and more specifically vocal strain increased tension and discomfort, and an interference with teaching and speech recognition. (p. 364)

Signal to noise ratio (SNR) is the “relationship between the intensity of the intended signal and the intensity of the background noise at the child’s ear.” (p. 364) In addition, reverberation time (RT) is the amount of time it takes for the sound to dissipate in a room, and together these factors impact on how a child will hear in the classroom. The higher the SNR and the shorter the RT’s, the better the environment for the students to be learning.

Crandell & Smaldino discuss how these factors impact students with a sensorineural hearing loss compared to students with normal hearing. Speech perception was assessed with monosyllabic words under various SNRs and RTs. The results

(See Table 1) indicated that while all children performed poor as SNR decreases and RT increases, the children with hearing impairment performed significantly poorer than did the children with normal hearing across most listening conditions. (Crandell & Smaldino, 366)

Testing Condition	Normal hearing Group	Hearing Impaired Group
RT=0.0 second		
Quiet	94.5	83.0
+12 db	89.2	70.0
+6 db	79.7	59.5
0 db	60.2	39.0
RT=0.4 second		
Quiet	92.5	74.0
+12 db	82.8	60.2
+6 db	71.3	52.2
0 db	47.7	27.8
RT=1.2 seconds		
Quiet	76.5	45.0
+12 db	68.8	41.2
+6 db	54.2	27.0
0 db	29.7	11.2

Table 1. Mean speech recognition scores (in % correct) by children with normal hearing (n = 12) and children with sensorineural hearing loss (n = 12) for monosyllabic words across various signal-to-noise ratios and reverberation times (RTs). (Crandell & Smaldino, 367)

Another study of, 1,200 children with varying degrees of hearing losses demonstrated that even a slight hearing loss (15dB HL PTA) has negative consequences. Specifically 37% of the children with slight hearing loss repeated at least one grade in school, compared to only 3% of the control group of matched peers.” (Nelson, & Soli, p. 358) The authors state that: “Students who do not have full access to spoken information in classrooms either from their teacher or from peers cannot be expected to learn at a normal rate.” (p. 359) Similar results are reported for hearing students for whom English was not their primary/first spoken language.

Research demonstrates that all children have difficulty understanding speech in noisy, reverberant environments and that the presence of hearing loss further compounds the issue. (Sorkin, p. 385) These findings suggest that acoustics in the classroom “should be addressed as an accessibility feature under the Americans with Disabilities Act. (Sorkin, p. 385) Parents are becoming knowledgeable and have begun requesting that classroom acoustics be included on their child’s individualized education program (IEP). This is particularly true of the increasing number of parents who elect for cochlear implants and a mainstreamed, oral/aural education for their children.

Conclusion

In summary, acoustics in the classroom seems to be the ‘forgotten variable’ when discussing a student’s education. As teachers we can educate school administrators and advocate reducing noise distractions that occur both inside and outside the classroom. Unfortunately due to financial constraints, large scale renovations are impractical in most schools. Fortunately there are low cost modifications and administrative controls that can

Carolyn Tully
Thesis

greatly enhance the acoustics within a given school. This is why it is important that individual teachers be aware of the issues, implications, and everyday strategies to enhance their immediate teaching/learning environments.

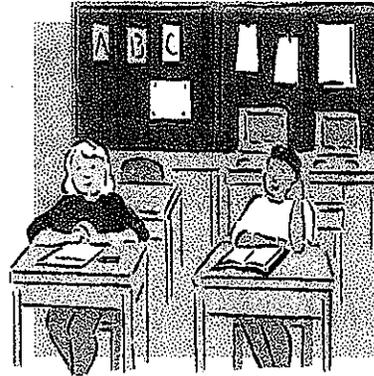
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Appendices

Please see attached for the brochure.

Acoustics in the Classroom: A Guide for Classroom Teachers



By: Carolyn Tully

Faculty Advisors:

* Josara Wallber

* Amanda Davis

* Communication Studies and Services
Department



Why is this important?

- * Research has shown noise has profound negative consequences for classroom learning.
- * Noise: masks (covers up) speech sounds.
- * Reverberation: Echoes off hard walls, windows, and floors and degrades speech understanding.
- * Distance: Further from student the quieter your voice is.
- * Hearing Aids and cochlear implants make all sounds louder for Deaf and Hard of Hearing students but not necessarily clearer.

What Can I do to help?

- * **Speak Clearly:** Speaking with an appropriate tone and volume at all times will help all children in the class. Repeat and rephrase important information when appropriate.
- * **Arrange the desks in a semi-circle:** This arrangement avoids having to place children in the back of the class and assures each child is receiving your message with the same intensity (other students are not blocking the sound.)
- * **Speak from a central location in the classroom:** Although standing in one place and teaching is impossible and boring, try to stay in close proximity while lecturing the class. Avoid turning back while talking. Face class at all times when speaking.
- * Provide visuals such as pictures, handouts and overheads to reinforce what is being said in the classroom.
- * Place noise producing items (pencil sharpener, computers, aquarium) in separate work

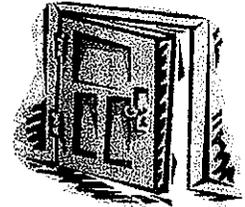


Tips for a quieter classroom:

- * When possible use a carpeted classroom or add area rugs.
- * Reduce bare wall space by hanging posters, projects, etc. Plus students will feel proud of their work hanging up in the classroom. 😊



- * Keep the classroom door shut to eliminate noise from the hallway.



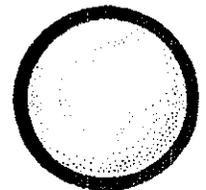
- * Put drapes on the windows.

- * Keep windows shut during instruction time.

- * Seat the student with listening devices away from windows.



- * Cover chair and desk legs with rubber tips or tennis balls.



SELF TEST

Is my classroom quiet enough for my students to learn??

- My classroom seems quiet to me.
True False
- I rarely have to raise my voice to be heard.
True False
- I often suggest to the students to use their inside voices.
True False
- My classroom is carpeted.
True False
- There are drapes in my classroom.
True False
- The walls of my classroom are decorated.
True False
- Computers in my classroom are not contributing to the noise.
True False
- While teaching, I always close the door.
True False
- While teaching, I often leave the windows closed.
True False
- Students rarely ask me to repeat myself.
True False

* If you answered False to any question, your classroom listening environment may need improvement.

* Where can I go for more information?

<http://www.nfd.org.nz/>

<http://www.nonoise.org/quietnet/qs/ica22001.htm>

<http://asa.aip.org/classroom/booklet.html>

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