

# Classroom Acoustics: The Untreated Learning Environment

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*(Sidebar)Editor's note: Greg Hubert lives in Naperville, Illinois, a suburb of Chicago with his wife Shelley and two daughters who are deaf. Nicole uses bilateral cochlear implants and developed her listening and spoken language skills through an auditory-verbal approach. She has been mainstreamed since three months of age in the infant program in Montessori school. She is now in middle school with a Section 504 plan. Josselin didn't receive any help in the first six years of her life in her native country of Honduras. She cannot benefit from hearing technology. The Hubert family, including Nicole, learned cued speech to help Josselin develop communication and language skills. Josselin is now learning sign language in a junior high program that uses conceptually accurate signed English. Greg is also the oldest son of two parents who are deaf. He can be reached through email at [gregoryLhubert@att.net](mailto:gregoryLhubert@att.net).*

## **Preface**

In 2002, with the support of the United States Access Board and the Acoustical Society of America, a classroom acoustics standards document "ANSI/ASA S12.60-2002 Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools" (ANSI S12.60-2002) was approved. Yet today, the implementation of standards for classroom listening conditions (acoustics) remains voluntary across most of the U.S.A.

We have a new advocacy opportunity with the change in Federal Government leadership in Washington, D.C. The American Speech-Language-Hearing Association (ASHA) has also taken a leadership role by making classroom acoustics a national priority of its public policy agenda.

## **Early ID and Intervention Meets Classroom Noise**

My conversations with other parents on the subject of classroom listening conditions often turn to two of my father's favorite questions. "Why?" and "How come?" My dad was born in the USA in an era long ago when a child who was deaf didn't usually get help until it was time to start elementary school. He was deprived of access to communication and language until he was five years old, so English language literacy is not one of his strengths.

Today, we are so incredibly blessed by newborn screening, hearing technology, and early intervention services. We recognize the vital importance of bathing our young children in the communication and language that surrounds them. However by the time our child gets to the elementary school classroom, we seem to value only the teacher-to-student communication. As long as our child is using an FM system or sound field system for the teacher's voice, and our child is getting good grades, everything is great. Right?

Have we forgotten the voices of all the other students in the classroom and our child's essential connection to his/her classroom peers? Why? How come?

Let me take a step back and ask you about your own listening experiences. Have you ever been in a noisy restaurant with a group of family, friends, or business associates? The restaurant seating was challenging, and you ended up sitting at one end of the table with the majority of the important conversation taking place down at the other end. How did it feel to be so isolated? Could you ever really know for sure what you were missing of the critical conversation a few feet away?

### **What the Experts Tell Us**

Please carefully consider the following:

- The Acoustical Society of America's booklet "Acoustical Barriers to Learning" shares with us the impact of listening barriers on our children's learning from teachers and peers:  
*"Students who do not have full auditory access to spoken information in classrooms (from the teacher or from peers) do not learn at a normal rate. The literature demonstrates that even slight hearing loss is often accompanied by delayed acquisition of vocabulary, reduced incidental learning, frequent significant academic delay, and limited reading abilities (e.g., Ross, 1990). However, none of these deficits is a necessary consequence of hearing loss. They are consequences, rather, of reduced communication opportunities between the child with hearing loss and that child's teachers and peers. If the acoustic barriers to communication can be overcome, then we can facilitate learning for all children."* (page 8.)
- In her book, Facilitating Hearing and Listening in Young Children, Carol Flexer, PhD, paints a very clear picture using an illustration of a young child with hearing loss on page 14. The child is enveloped in a bubble that interferes with access to spoken language. Dr. Flexer emphasizes the warning message of Mark Ross, PhD, by using a bold, italics font:  
***"Beware of underestimating the barrier that any type and degree of hearing impairment presents to the casual acquisition of information from the environment."***
- In the very first issue of Advanced Bionics' *Loud and Clear* newsletter in 1998, Amy McConkey Robbins, M.S., CCC-SLP, helps us to see the critical importance of incidental language learning. Even ten years ago, she shared that auditory learning potential was being seen in young children who are deaf through cochlear implant technology available at the time. She describes how that auditory learning potential was changing the prevailing assumption of the day -- that a child could learn only what was directly taught to him/her. She cautions us that many opportunities for incidental learning will be lost if we continue to assume learning is completely dependent on direct instruction. With one simple sentence, she says it all:  
"It [incidental language learning] is the most efficient, and perhaps the *only* way to truly master a spoken language."

- In the American Speech-Language-Hearing Association (ASHA) position statement on classroom acoustics, ASHA tells us that it is much more than just an issue of grades on a report card:  
"It is well recognized that the acoustical environment in a classroom or other educational environment is a critical variable in the academic, psychoeducational, and psychosocial development of children with normal hearing as well as children with hearing loss and/or other disabilities (e.g., auditory processing disorders, learning disabilities, attention deficit disorders)."

If you aren't hooked yet, please let me try one more quote that comes from our family advocacy efforts on behalf of our daughter Nicole. We face a very challenging school district, and these compelling words are contained in a letter to our school district from our auditory-verbal therapist, Lynn Wood, M.A., CCC/A, Cert AVT:

"The detriment to learning is not her own hearing loss, which has been technologically and therapeutically well managed, but instead it will be the school's learning environment if left untreated."

### **Details on Classroom Acoustics**

Background noise and reverberation are two significant classroom listening issues that can interfere with our children's access to spoken language. Some of the most challenging problems are caused by deficiencies in the design of the school facility itself.

Background noise competes with important speech signals. Poorly designed heating, ventilation and air-conditioning (HVAC) systems and noisy equipment choices are often a source of background noise. External noise that penetrates into the classroom from outside locations can be another problem area.

Reverberation is caused by sound that reflects off hard floors, walls, and ceilings in the classroom. We usually want spoken language to reflect to help carry it out to everyone in the classroom, but when the speech signal continues to bounce around the room you have an excess level of reverberation. Excess reverberation causes the speech sounds to overlap, so that speech becomes smeared and difficult to understand.

Both speech levels and background noise levels are measured on a decibel (dB) scale. A simple comparison between the two is called the signal-to-noise ratio (S/N). The S/N describes the difference between the sound level of a speaker's voice compared to the sound level of the competing background noise.

The +15 S/N criteria in ANSI S12.60-2002 describes a speech signal that is 15 dB greater than the background noise, while a -5 S/N describes a background noise level that is 5 dB greater than the speech signal. A 0 S/N tells you that the measurements of speech and background noise are equal. With a +15 S/N our daughter Nicole scores near 100% in speech recognition, but she falls dramatically to 64% with a +5 S/N. At 0 S/N, she scores a mere 10%.

Reverberation is measured in tenths of seconds. When speech sounds are not absorbed in a time frame of 0.6 seconds or better, then they continue to bounce around the room and interfere with speech intelligibility.

Amplification systems such as FM systems and sound field systems can generally do a pretty good job in providing access to the teacher's speech as long as the underlying classroom acoustic conditions are not extreme. Many systems also offer the option to utilize a second microphone (mic) to be passed around for student use.

It is our experience with Nicole that widespread student use of either a second mic or sharing of the teacher's mic is not very practical in the typical classroom setting. In early elementary school, many students are not sufficiently mature to handle the mic properly. A mic can generally work well with students who come to the front of the room to make presentations. The more typical interactions of short questions, answers, and comments don't lend themselves well to the time delays in passing a mic around a classroom of 25 and more students. Even well-intentioned teachers sometimes fail to repeat the comments of students, and they will even sometimes edit and re-phrase the comments for general class consumption without the grammar mistakes, idioms and "cool" expressions of the kids.

If you find young oral adults to share their experiences, they will many times be willing to tell you about missing out on the language of their peers in school. In our community, a child psychologist also shared with us that a simple indicator of the successful socialization of local pre-teen girls can be found in the expressions and mannerisms in how the girls talk. These girls are certainly going to have to be able hear their peers well enough to be able to adopt the expressions and mannerisms currently in vogue.

### **But You Said...**

Let me share my own personal story as the oldest child of parents who are deaf. At home as a young kid, I naturally picked up the occasional word mispronunciations from my mother, who had learned spoken language without benefit of hearing technology. The outside world quickly straightened me out when I made those very noticeable pronunciation or other language errors in public. Forty-five years later, I still remember the depth of the embarrassment with my new fifth grade classmates who roared in laughter when I pronounced the word "phlegm" as "flame." Take a moment to appreciate the mispronunciations and other errors that our children will pick up through the limits of their hearing aids and cochlear implants, and then pile on classroom listening conditions that are not even adequate for children without hearing loss. While picking up such errors through incidental learning, as I did, is amazing in itself, improving acoustics is all the more important for these children who are able to learn through overhearing.

Another area where poor classroom acoustics concerns us is the issue of possible physiological and mental stress from bombardment by background noise in the classroom. We haven't yet found research evidence specific to this issue of the stress on children who are using hearing aids and cochlear implants, and it hasn't so far become a

major issue for Nicole. If you've ever listened to fan noise through a hearing aid using a testing stethoscope, it will give you cause to think about this noise stress issue.

Even when using an FM system, most hearing aids and cochlear implants are still receiving a good portion of the signal from the environment. Nicole gets a 50% feed directly from her FM and 50% of the signal from the environment into one implant. Her other implant is not connected to the FM, so 100% comes from the environment. Therefore she is getting 75% of her overall auditory input from the classroom, along with all of its background noise. The FM system mic can pick up background noise, too.

### **Learn More**

Families are successfully using ANSI/ASA S12.60-2002 as an advocacy tool in the development of their child's IEP or Section 504 plan. Some are also having a positive advocacy impact within their school districts. Please use the power of knowledge to help create an appropriate listening environment for your child and the other children in your schools.

Here are my top four recommendations for additional sources of information to begin this process: (sources follow article)

- 1) United States Access Board's Classroom Acoustics Page
- 2) Acoustical Society of America's Classroom Acoustics Booklet I
- 3) Students and Soundwaves: Five Strategies to Promote Good Classroom Acoustics by Joseph Smaldino, PhD, CCC-A
- 4) National Clearinghouse for Educational Facilities Resource List: Classroom Acoustics

### **One Person *Can* Make a Difference: Get Involved**

One mom, acting alone, started the classroom acoustics ball rolling in 1997 with a petition to the United States Access Board. Widget Richards' efforts ultimately led to the development of ANSI/ASA S12.60-2002.

Some families have now been successful in advocacy efforts at the state and local level in getting acoustics standards included into code, ordinances or regulations. The Access Board's webpage shares information on those local successes.

Other families have encountered school district administrations that are not yet supportive of the listening needs of our children. Lack of legal precedents in both IDEA and Section 504 law leave families with challenging situations. In our own case, Nicole's straight A's along with her self-confidence and good self-esteem just don't give us the obvious evidence of harm that is needed for a due process system that prefers to act only after there is failure.

Now we again have new opportunities. We have a new president, a new Congress, and a great sense of optimism in our nation. ASHA has stepped forward to take a further

leadership role by making classroom acoustics a national priority of its public policy agenda. Neil Snyder, ASHA's Director of Federal Advocacy, has created a Facebook group called "Classroom Acoustics Coalition," so please come join us on Facebook [www.facebook.com](http://www.facebook.com).

As the parents of a child who depends fully on a technology-aided, auditory modality of communication, my wife Shelley and I strive to remove the needless listening barriers that exclude Nicole from full participation in her school. Given what we have learned about classroom acoustics, we also advocate for the listening needs of the other children who are known to be at risk and adversely impacted by poor listening conditions. Missed opportunities for communication and language in the most critical time of neurological development of the young mind are quite simply lost forever. The window of opportunity closes with each and every precious day.

In closing, please let me share one line from the testimony of Professor Robert E. Apfel, Visiting Professor of Architecture at Yale University. His testimony was provided in response to the Access Board's 1998 Request for Information on the subject of classroom acoustics. He so eloquently expresses the ultimate "why" and "how come":

"Moreover, when bad acoustics are a primary reason for prohibiting students with disabilities the opportunity to benefit from education or it increases the cost of education, the students and we are all poorer."

Resources:

1. United States Access Board's Classroom Acoustics Page  
<http://www.access-board.gov/acoustic/index.htm>
2. Acoustical Society of America's Classroom Acoustics Booklet I  
<http://asa.aip.org/classroom/booklet.html>
3. Students and Soundwaves: Five Strategies to Promote Good Classroom Acoustics  
By Joseph Smaldino, PhD, CCC-A  
The ASHA Leader Online  
<http://www.asha.org/about/publications/leader-online/archives/2008/080923/f080923b.htm>
4. National Clearinghouse for Educational Facilities  
Resource List: Classroom Acoustics  
<http://www.edfacilities.org/rl/acoustics.cfm>

References for this article (in the order referenced):

Classroom Acoustics II: Acoustical Barriers to Learning  
A publication of the Technical Committee on Speech Communication  
of the Acoustical Society of America,  
<http://asa.aip.org/classroom/bookletII.pdf>

Facilitating Hearing and Listening in Young Children  
By Carol Flexer  
1994 Singular Publishing Group, Inc.

“Two Paths of Auditory Development for Children with Cochlear Implants,”

by Amy McConkey-Robbins

Loud and Clear Volume 1 Issue 1

A publication of Advanced Bionics Corporation

[http://www.bionicear.com/userfiles/File/Vol1Issue1April\\_98.pdf](http://www.bionicear.com/userfiles/File/Vol1Issue1April_98.pdf)

Acoustics in Educational Settings: Position Statement

American Speech-Language-Hearing Association

<http://www.asha.org/docs/html/PS2005-00028.html>

Coalition for Classroom Acoustics’ Response to Federal Access Board’s Request for Information on Classroom Acoustics

Submitted on Behalf of the Coalition for Classroom Acoustics

by Prof. Robert E. Apfel, Visiting Professor of Architecture, Yale University

<http://www.quietclassrooms.org/library/coal-rfi.htm>