



COMMUNICATION CONSIDERATIONS A-Z™

Classroom Acoustics

by Lois Thibault, Research Coordinator, US Access Board

1. What is the 'classroom acoustics' initiative about?

Parents and education professionals across the country have been working hard to ensure that America's classrooms are not subject to unnecessary noise that interferes with our children's education. One of the most important steps in this effort was the establishment, in June 2002, of a new standard for classroom acoustics. ANSI/ASA S12.60-2002, developed by the Acoustical Society of America working with the US Access Board and other stakeholders -- parents, teachers, and organizations like SHHH and AGBell, ASHA, EAA, and AAA -- was published by the American National Standards Institute for the use of parents, school systems, and school planners and designers. It sets maximum levels for background noise and reverberation to insure good speech intelligibility in learning environments. Designing to meet these criteria will provide room conditions that enable all children to hear and understand. Many parents have found the new standard useful in obtaining acoustic accommodations under the Individuals with Disabilities Education Act (IDEA).

Good acoustics -- quiet learning spaces -- are especially important for young children, for those whose home language is not English, for kids who have learning disabilities and those with speech impairments, and for children with temporary (because of colds and earaches) and permanent hearing loss. If you add up the numbers, as many as one-third of the children in your elementary school may be doubly disadvantaged by excessive noise and reverberation in their classrooms -- noise that most adults wouldn't identify as a possible cause of educational delay and failure.

We all know how hard it is to understand speech in noisy situations. A conversation in a noisy restaurant, construction noise outside of our office window, a loud air conditioner, any one of these conditions leaves an adult straining to hear. Adults are experienced and skillful in listening in noise, but it's a much harder task for your child, whose listening and language skills are not yet well developed.

Children who have hearing loss experience the greatest challenges in acoustically inappropriate classrooms; quiet rooms allow them to use hearing aids and cochlear implants far more effectively. But research shows that all children will benefit from classrooms with low background noise and short reverberation times. Even children with hearing in normal ranges can miss as much as one-third of the words in a teacher's message when they are listening in noise.

2. What issues are at the forefront of classroom acoustics?

The societal costs of delay, failure, and unrealized potential that may be attributable to poor listening and learning conditions in schools are rarely considered when school systems consider cost-cutting measures when a new school comes in over budget. An all-too-easy target for savings are construction details and materials that support effective classroom listening. And yet a 1995 government study revealed that almost 30% of responding school systems identified noise control as their primary environmental problem. It is interesting to note that an estimated 30% of incarcerated adults evidence hearing loss and attendant communications difficulties; that children diagnosed with hearing loss are 3 times more likely to repeat a grade than their age peers with hearing in 'normal' ranges; and that brain and neurological maturation in children has been linked by researchers to the successful development of a system of communication. Poor acoustics compromise the acquisition of language and reading skills and waste our education tax dollars.

Only 10% of a school system budget is expended on school facility design and construction. These are capital costs, one-time expenditures for a facility with a lifetime of thirty or more years during which time the school will serve thousands of students with a wide range of needs. The remaining 90% of the school system budget is allocated to programs -- staff, operations, and services costs that include special education programs and services, accommodations for individual students as they move through the system, even outside placements if accommodation is not feasible. These are substantial and annually recurring costs.

And yet the additional cost per new classroom for good acoustical performance is not high, ranging from about \$1500 for top quartile school spenders to \$4500 for low-spending systems. So it should be an easy choice to invest in the futures of all children by emphasizing good classroom acoustics in the design of new and the alteration of existing schools. Schools that practice sustainable design will have already specified 90% of the items needed for effective listening and learning.

3. What should every parent or professional know about classroom acoustics?

Reverberation adds noise and makes the listening task more difficult for kids at risk, particularly those who use hearing aids or have cochlear implants. The surfaces of a reverberant room don't absorb enough

sound, so it bounces around, arriving at the ear over and over again and smearing the sounds that kids are trying to hear. Excessive reverberation makes understanding impossible, even if the volume of the signal is very loud. Fortunately, reverberation is easily treated with high-quality ceiling tiles, so it makes good sense to deal with it first. . The new ANSI/ASA S12.60-2002 standard sets maximum reverberation time at 0.6 to 0.7 seconds, depending on room size.

Background noise may come from nearby land uses, activities in adjacent rooms and corridors, and heating, ventilating, and air conditioning equipment (HVAC). A ducted (rather than unitary) HVAC system, insulated window units, and wall and roof construction that resist sound transfer are needed to meet the ANSI/ASA S12.60-2002 criteria. A classroom with an unoccupied background noise level that consistently exceeds the 35 dB(A) maximum specified in the classroom acoustics standard cannot deliver the speech intelligibility young children need for language acquisition and reading.

Technology can help. Kids who have hearing loss will benefit from a personal FM receiver, but for maximum gain and effectiveness, reverberation and background noise must be limited, too, since hearing technologies amplify room noise as well as the desired signal of the teacher's voice. Beware the use of soundfield systems used in lieu of providing good room acoustics – like the PA systems in a train station, they can exacerbate the listening difficulty.

4. Where else can I find information about (this subject)?

The US Access Board website at <http://www.access-board.gov/acoustic/index.htm> has links to a wide range of resources, including a free copy of the S12.60-2002 standard. Stakeholders participate in an active listserv at classroomacoustics@yahoo.com.

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