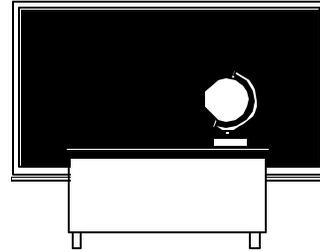


LISTENING FOR LEARNING 4:



A CHECKLIST FOR CLASSROOM ACOUSTICS

Although adult listeners can't really model the true difficulty of the listening task for children -- kids who are just learning language and reading skills need higher speech intelligibility values than do adults -- parents who are concerned about the environment their children are learning in can take some simple steps to determine if a classroom may need acoustical remediation. As many as one-third of the children in any elementary school classroom on a given day may be 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.

Is reverberation a problem? 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, so it makes good sense to deal with it first. There's no easy test or meter to check for excessive reverberation, so you'll have to use visible clues instead. Expect problems if:

- ...the room has a hard ceiling with no acoustical ceiling tiles;***
- ...the room has very high ceilings (> 10 feet);***
- ...the ceiling tiles have been painted, eliminating much of their absorption;***
- ...the ceiling plane is more than 10% occupied by light fixtures, HVAC grilles, or other non-absorptive surfaces.***

It's possible to calculate room reverberation in a fairly simple surface area calculation if you know the coefficients of absorption of the floor, wall, and ceiling finishes. See <http://hyperphysics.phyastr.gsu.edu/hbase/acoustic/revmod.html> for the Sabine formula, instructions, and a table of materials if you want to try it yourself. The new ANSI/ASA S12.60-2002 standard sets maximum reverberation time at 0.6 to 0.7 seconds, depending on room size.

Is background noise a problem? The most easily diagnosed sources of background noise include nearby land uses, activities in adjacent rooms and corridors, and heating, ventilating, and air conditioning equipment (HVAC). Others may require the services of an acoustical consultant. Try these tests in an unoccupied classroom:

- ☑ ***Is HVAC noise clearly audible?*** Ask the teacher if he/she turns off the HVAC for important lessons. Equipment that hisses or rumbles louder than a loud whisper will mask the consonant sounds kids need to correctly interpret the words they hear.
- ☑ ***Can you hear outdoor noise such as playground activity or automobile traffic from a roadway?*** Isolated examples may be only occasionally disturbing, but constant noise will affect speech intelligibility in the classroom by competing with the desired speech signal.
- ☑ ***Is noise from adjacent spaces adding decibels to the background noise levels?*** Try this test with the HVAC off. If you can hear the choir practicing, the teacher in the next room giving instructions, or the toilets flushing in the bathroom down the hall, the walls or the openings in them may not be adequately protected against noise transmission. Excessive background noise forces speakers in the classroom to raise their voices and this adds even more volume.

Here is a test you can use to simulate how kids listen in noise; try it with all HVAC, lighting, and equipment operating in an occupied classroom. Find and stand in the noisiest spot in the room. Close your eyes (so you can't lipread!) and listen to the teacher read a list of similar words [bat/pat; hip/hit; taste/race] at ordinary volume from a distance of 10 - 12 feet. If you don't get all of the words right, the classroom probably needs acoustic remediation.

You can also use a soundmeter to test for background noise; your school's audiologist or speech therapist may have the necessary equipment. Make sure it's a good quality (that is, not cheap) device that can give readings below 35 dB(A). Take readings at many points in the room, particularly near identified noise sources. 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.

See *Listening for Learning 5: Retrofitting a Noisy Classroom* for tips on addressing any problems you've identified. You may want to involve an acoustical consultant to test classrooms and other spaces, to diagnose the sources of noise, and to recommend treatments.

For more information... The ANSI/ASA S12.60-2002 standard for classroom acoustics was developed by the Acoustical Society of America (ASA) in collaboration with the U.S. Access Board and other stakeholders. Information on ordering the standard and other materials on classroom acoustics, including a videotape, design manuals, and a bibliography, are available on the Board's website at <http://www.access-board.gov/publications/acoustic-factsheet.htm>. The Board also maintains a toll-free technical assistance line at 1/800/872-2253 (v); 1/800/993-2822 (tty).