



Designing Classroom Acoustics for Better Academic Performance

Research has shown that noise and reverberation (the persistence of sound after the source itself stops) adversely affect normally developing young children more than they affect typical adults.¹ It is difficult for a typical child below the age of 13 to hear what is being said in a classroom if there is substantial background noise, which can come from internal sources such as the HVAC system, computers, electrical appliances and the children themselves—or external sources such as highway and airport traffic.

Poor classroom acoustics interfere with all students' learning but pose a particular challenge for those with special needs. This includes students who are coping with learning disabilities, learning in a second language, or having trouble hearing due to ear infections or more permanent conditions like noise damage.

The challenge is to design classrooms that meet children's unique learning needs for sound (as well as lighting, comfort and seating). All sound sources in a room must be considered.

The American National Standards Institute (ANSI) and the Acoustical Society of America (ASA) developed the current standard for classroom acoustical design. The standard, ANSI/ASA S12.60, Acoustical Performance Criteria, Design Requirements and Guidelines for Schools, was completed and approved in 2002.

Good classroom acoustics can be achieved if they're considered at the start of a design project, and with early collaboration among school planners, architects, contractors and suppliers.

Many factors should be considered, including:

- Size and shape of the classroom – building designers should avoid open-plan classrooms that provide little opportunity to acoustically isolate one activity area from another
- Classroom placement relative to other interior spaces – designers should arrange these to minimize the effects of occupancy-, equipment- and environment-related noise that comes from outside the classroom walls.

- Construction of ceilings, walls and floors – designers should select construction materials with the right Sound Transmission Class (STC) ratings for slab, roof and exterior walls, including doors and windows
- Surface treatment, which determines sound absorption
- Number, type and location of both internal and external sound sources, and the strength of the sounds they produce.

The heating, ventilation and air conditioning (HVAC) system must be taken into consideration during the initial building design phase because it's often the predominant noise source in a classroom. The ASA says that if the system is designed properly, excessive mechanical noise can be substantially reduced at little or no extra cost if the system is designed properly.

Select systems and new technologies with low sound levels and to identify system designs that meet specific acoustical goals. In many cases, lessen electrical energy consumption as well.

And plan with the use of acoustical prediction and analysis software. This software takes into account different sound sources and accurately predicts what a classroom's sound level will be. Inputs include specific building requirements along with the type and placement of HVAC equipment, duct configuration, and wall and ceiling type.

In the end, a good listening and learning environment is achievable if classroom acoustics are considered at the outset of the design process, and with early collaboration among school planners, architects, contractors and suppliers.

For more information on planning for good classroom acoustical design, contact your local Trane sales office.

1 – Sound in the Classroom: Why Children Need Quiet, ASHRAE Journal, February 2003

2 – Acoustical Society of America (ASA). 2002. ANSI S12.60: Acoustical Performance Criteria, Design Requirements and Guidelines for Schools (Melville, NY: ASA), 5.



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