AMERICAN SCHOOL & UNIVERSITY

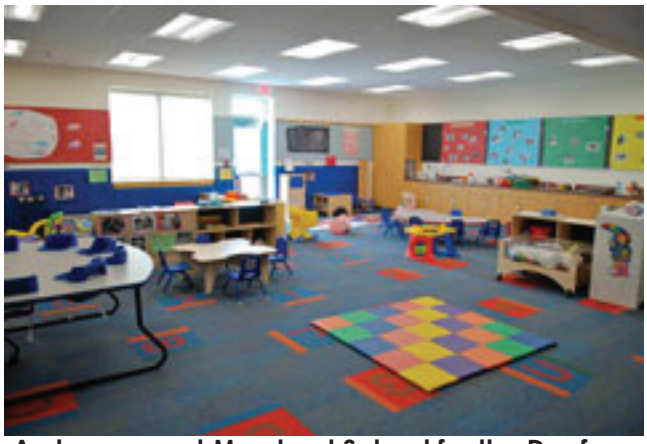
# Listen and Learn

Feb 1, 2011 12:00 PM, By Jeffrey Fullerton and Peggy Nelson

**The updated ANSI classroom acoustics standard remains an important element of classroom design at all levels.**

In the past eight years, the design standards of classrooms have improved significantly. This movement was instigated by the introduction of the classroom acoustics standard in 2002 from the American National Standards Institute (ANSI), in collaboration with the Acoustical Society of America.

The standard, formally known as ANSI S12.60, has become a design requirement within numerous state, county and local public school systems, and has been partially incorporated into both the LEED for Schools and Collaborative for High Performance Schools (CHPS) rating systems. These developments primarily have occurred in the K-12 environment and have had limited influence on higher-education institutions.



**A classroom at Maryland School for the Deaf, Frederick, Md., was designed consistent with achieving the ANSI S12.60-2002 classroom acoustics standard.**
Photo courtesy of Jeffrey Fullerton

**Making standards**

Originally released in 2002, the ANSI S12.60 standard was revised and updated in 2010. The new version includes two parts covering the acoustical goals for permanent schools (Part 1); and relocatable (modular) classrooms (Part 2). These parts are intended to provide numerous benefits from the classroom acoustical design performance goals, including maximizing the intelligibility of the spoken word from teachers and students, improving the audibility for persons with hearing impairments, reducing distractions from activities outside of the classroom, promoting productivity and focus of students, and relieving the vocal stress and fatigue of instructors.

In the standard, there are three basic components to the classroom acoustic design for achieving the goals described above:

- Low background noise from building systems, such as the HVAC, plumbing, electrical and elevator systems.
- Enhanced acoustical privacy for neighboring spaces and the exterior.
- Limited reverberation in the classrooms.

These conceptual goals are applied to core learning spaces or classrooms up to 20,000 cubic feet in volume. There are performance goals for ancillary learning spaces, including corridors, cafeterias and gymnasia of any volume, where learning may be a secondary purpose but communication still is important to the function of the spaces.

The details for the performance goals are described in the standard, which can be downloaded free at http://tinyurl.com/ANSI-S12-60.When spaces are built that achieve these goals, the education environment is enhanced.

**Design implications**

The quantitative performance goals in the ANSI standard influence classroom design in several important ways. First, the goals require that the classroom envelope isolate noises from the learning environment. For interior adjacencies, the demising walls between classrooms require additional layers of drywall, insulation and effective sealant around the partition perimeter. If necessary, the facility may include upgraded exterior facades and sound-isolating exterior windows and doors for schools situated in noisy urban areas or near heavy transportation routes. Constructions to achieve this greater acoustical isolation often provide thermal insulating upgrades also, which can be a cost savings and thermal comfort benefit for facility managers and users.

Second, low background-sound goals in classrooms typically are accomplished with well-designed, centrally situated HVAC systems. These systems avoid the older noisy style of unit ventilators or fan-coil units, which impeded the hearing for students whose seats were nearby. This equipment no longer is acceptable from an acoustical perspective for the classroom environment. The newer centralized systems can be designed more easily with noise control in the ductwork and vibration isolation of the main equipment. Achieving low background sound levels also requires low airflow velocities and proper selections of supply diffusers and return grilles to minimize turbulent airflow noise. Together, these elements can achieve the desired results of exceptional listening conditions for all students within the classroom (not just the ones in the front row).

Finally, classrooms require sound-absorbing finishes to limit the buildup of reverberation within these spaces. Without sound-absorbing surfaces, successive sound reflections off hard surfaces within the rooms can create a sense of noisiness and excessive loudness, which leads to lower comprehension of oral instructions. Sound-absorbing surfaces applied to the ceiling often are sufficient for reducing the excessive buildup of reverberation and noise, resulting in an improved acoustical environment that enhances the intelligibility, clarity and comprehension of speech in typical classrooms. Taller classrooms may require additional sound-absorbing finishes on some of the walls to achieve the same reduction of reverberation.

**Equal time**

As described earlier, the acoustical performance goals have become design requirements for many K-12 schools. This has been accomplished through several state, county and local school systems adopting the ANSI standard as a requirement for new and renovated public school projects. The other way in which the ANSI standard has influenced K-12 school design has been through the LEED for Schools and Collaborative for High Performance Schools rating systems. Both rating systems have been based on the 2002 version of the ANSI standard, but they allow some deviation from strict compliance with the ANSI goals. Ultimately, the use of the ANSI goals within these rating systems introduces acoustical topics into the discussion of classroom design. With all of this activity, it now is clear that many schools are being designed for enhanced acoustical performance.

On the other hand, except for two known cases, none of the mechanisms that have introduced the ANSI classroom acoustics standard to the design of K-12 schools appear to be influencing higher-education institutions. The two exceptions are the University of Minnesota and Pennsylvania State Univer-

sity, which have included references to the ANSI standard in their campus facilities guidelines and requirements.

This lack of adoption by higher-education institutions may be due to at least two factors. First, many higher-education facilities historically did not use unit ventilators or under-window fan-coil units. This difference of mechanical systems from the K-12 market is likely because of the interest of these institutions in having centralized control over the HVAC systems, rather than choosing what might have been the lowest-cost system. As a result of these centralized systems, noise control often is incorporated easily into the systems, providing quieter sound levels for these learning spaces.

Second, there is the assumption that students who enter colleges and universities have a better understanding of the vocabulary used by the instructors and are able to focus better than their younger counterparts.

However, it also is clear that there are significant reasons these students should not be deprived of the enhanced acoustical conditions outlined by the ANSI standard. First, more students are entering higher education with English as their second language, which presents significant cognitive challenges for these students. An improved acoustical environment can enhance the ability to comprehend speech.

Second, modern students have grown up listening with headphones to portable electronic music players. Studies have shown that a significant portion of this population suffers a degree of hearing loss from this exposure. The beginning stages of hearing loss often are undiagnosed and can leave a seemingly attentive student at a disadvantage to hearing and understanding.

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