

Hearing Yourself Think

Some children are being rendered helpless by the high levels of noise in their classroom.

By Stephen V. Prescod

(Dr. Prescod practices as an audiologist in Waterloo, Ontario.)

Very often a parent brings a child to my clinic convinced that the child has a hearing loss, only to be told after the examination that the child has normal hearing. One parent said to me in astonishment: "How can that be? I talk to him directly at times and he still says 'What?'"

Such a child can *hear* but not *listen*.

One of the areas most clearly delineated as a problem area for children with central auditory perceptual problems is their inability to function in a noisy environment. For these children, modern teaching practices such as activity-based learning and the open classroom concept are problematic.

There is simply too much noise in many classrooms for sound thinking and learning to take place effectively. As noise levels increase, meaningful dialogue between teacher and student, as well among students, decreases. Teachers strive to maintain some semblance of order and efficiency in the busy and noisy environment, but this is frequently impossible.

The threshold of annoyance and distraction varies from individual to individual. In the classroom where efficiency is demanded in the production of good mental and motor tasks, noise does affect performance, and the effect is greater where speech is involved.

What classrooms need today are so-called *performance zoning codes* which regulate noise levels within the classroom, keeping them at tolerable levels for greater productivity. If government can impose such noise limits in the workplace to ensure increased productivity, isn't it time to provide the same protection for our children?

The changes that occur in the thought processes of children due to the constant bombardment of noise have not been clearly documented. What has been determined, however, is that children's thinking is drastically altered by persistent noise. Some children characteristically cease to function.

Classroom Acoustics

Most classrooms are noisy, distracting and poorly designed from an acoustical standpoint. These classrooms make it virtually impossible for children to listen and thus to learn because of the ever-present environmental noise from factors such as fans, humming lights, hall sounds, and external noises such as traffic.

To compound the problem, in most cases there are sound reflections (reverberation), a part of noise signals that persists longer than the time necessary for the ear to respond. When reverberation occurs, it has an adverse effect on the function of the *basilar membrane*. The basilar membrane is the part of the ear responsible for analyzing sound frequencies as they impinge upon it.

In order for it to do this properly, the membrane must be heavily damped (decrease in vibration) for each signal to be properly analyzed. When this membrane is not properly damped, *overwriting* — one response on top of another — occurs.

In the event of reverberation, the basilar membrane is stimulated first by the direct signal reaching the ear already distorted by the noise, and then by the indirect signal that travels to the ear by bouncing off smooth surfaces. Coupled with an already-noisy environment, this is devastating for a child with processing difficulties.

Classrooms that are small, rectangular in shape, and with smooth surfaces are particularly vulnerable to reverberation. In order to counter this tendency, the use of acoustical absorption tile on walls and floors and even ceilings is recommended.

The reason that these children cease to function in noise is because of something called *psychoacoustical masking*. Psychoacoustical masking interferes with communication in a dramatic way. The ability of noise to interfere with speech communication is well-documented. Masking occurs when a signal (noise) alters the psychoacoustic perception of another signal (speech).

Though this noise may not be loud enough to cause a hearing disorder, it is intense enough to interfere with communication by speech. Noise as a masker raises the threshold for speech to a level where, if intense enough, it distorts the quality of the message until it is unintelligible or at times even inaudible.

Moreover, speech interference from noise is directly related to distance. The further a child is from the source of information, the more difficult it is to receive a clear message. As the signal weakens, the distortion increases. Therefore, when a child's teacher is trying to communicate with him from some distance, the intensity of the message is reduced by a factor of four or even sixteen depending on how far it must travel.

In noisy conditions, many children's processing mechanism becomes overloaded and consequently closes down. Central association and integration dwindle. The child ceases to listen. The child ceases to think.

At this point, the child has what can be described as *cortical dysacusis*, a form of deafness confined to the hearing centres of the auditory cortex. He tends to tune out a lot and is easily distracted. Yelling and threatening him to gain his attention only aggravates the situation by increasing noise levels.

Noise pollution has significantly modified his behaviour. Like many children who are having problems with logical thinking, processing, and problem-solving tasks, he has been rendered helpless by his classroom environment.

(Adapted with permission from Why Johnny Isn't Learning. See our review on p.3 of this newsletter.)