

## The Benefits of Classroom Audio Technology

*White Paper by Bruce Bebb, Marketing Communications Director, Lightspeed Technologies*

Classroom Audio Technology has been used effectively to enhance listening and learning environments for more than 20 years. The primary goal of CAT is to provide a high level of speech intelligibility and to evenly distribute sound throughout the classroom. Research, validated by the U.S. Department of Education, is clear, consistent and conclusive...all students benefit from classroom audio technology.

**"Hearing is the primary channel for learning. The more children hear, the better they learn."**

*—Dr. Mark Ross,  
University of Connecticut*

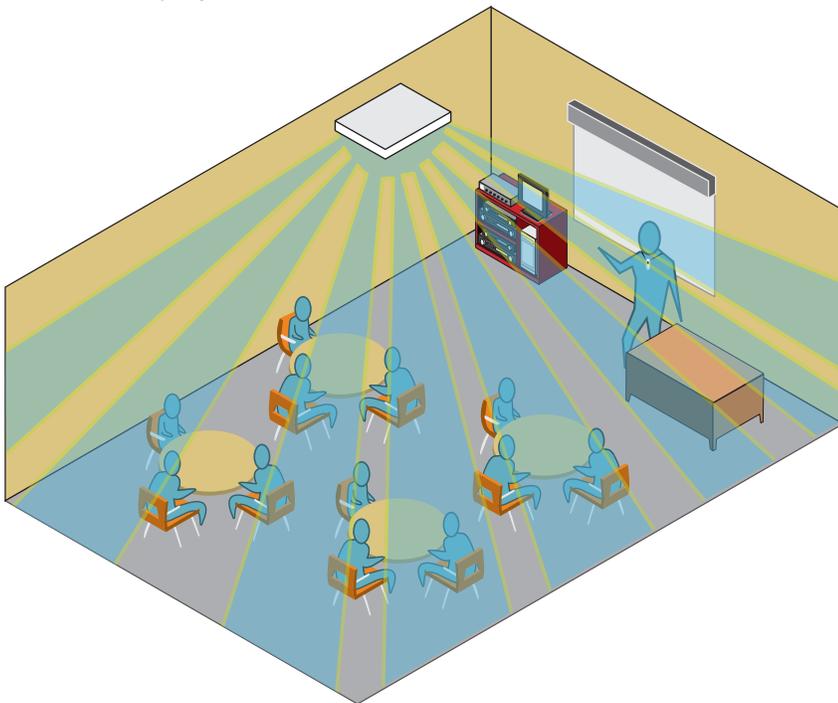
## Introduction

Recent studies have verified that hundreds of thousands of children are academically at risk due to a high incidence of poor classroom acoustics, high ambient noise levels in the classrooms, and mild hearing loss among pre-adolescents (K-6) due to common ear infections. These studies show conclusively that conditions in the majority of current kindergarten through 6th grade classrooms make it difficult for a significant portion of students to hear adequately. These same studies show that many of the children that are not hearing adequately become academically deficient in at least one subject by the 6th grade. The results from the largest study conducted, Mainstream Amplification Resource Room Study or the MARRS Project (1979–1993), have been validated by the U.S. Department of Education.

All the recent studies validate classroom audio as a proven tool that can overcome adverse classroom conditions, providing students with enhanced speech recognition and, therefore, much improved opportunity to learn. Sound-field classroom audio is now recognized as one of the most powerful and cost-effective tools for student improvement.

## What Is a Classroom Audio System & How Does It Work?

Infrared classroom audio systems may be installed or portable. They contain similar system components and operate in much the same manner. The teacher wears a lightweight wireless microphone that transmits the signal via infrared light to a receiver/amplifier unit. The voice is then amplified through loudspeakers and distributed evenly throughout the classroom. The amplified teacher's voice overcomes background noise, poor room acoustics and mild hearing loss to make it easier for students to concentrate on what the teacher is saying.<sup>(1)</sup>



**“Sound systems help level the playing field, allowing every child the opportunity to clearly hear the spoken instruction”**

*—Dr. Carol Flexer,  
Audiologist,  
University of Akron*

Infrared classroom audio has emerged as the perfect technology for delivering clear instruction to all students, mitigating poor acoustics and high ambient noise levels.

## The Goal of Classroom Audio Technology

Young children spend 75% of their school day involved in listening activities. Their primary channel for learning is hearing.<sup>(2)</sup> The better children can hear, the more they can learn.<sup>(3)</sup> For maximum learning to occur the teacher's voice must be highly intelligible to every child. Younger children's lack of experience and knowledge with speech and language makes them very dependent on the soft, subtle consonant sounds that make up the key elements of word recognition.

The goal of Classroom Audio Technology is to enable every child in a classroom to clearly hear all the speech components of the teacher's voice no matter where a child is seated relative to the teacher's position in the room.

*The following benefits of Classroom Audio Technology is a synopsis of related research projects. Detailed summaries are available upon request.*

## High Ambient Noise Levels Are Easily Overcome

The mix of various noises that make up the ambient noise in a classroom are composed of external noises like street traffic, construction, playground noises; general facilities noises like heating and air conditioning, hallway noises; and classroom noises like computers, printers, furniture movement, children talking, etc. Quantitative sound level measurements have revealed that occupied kindergarten classrooms can range from 65 to 75 decibels (dB), occupied elementary classrooms can range from 55 to 65 decibels, and occupied high school classrooms can range from 60 to 70 decibels. Since a teacher's voice level drops by 75% for a child 12 feet from the teacher, these levels of ambient noise significantly impair the listening ability of a child seated 12 feet or more from the teacher's position in the room. At these kinds of noise levels critical components of speech are masked and it is not uncommon to have less than 50% word recognition for a K-3 child seated 12 feet or more from the teacher.

Classroom Audio overcomes ambient noise levels and distributes the teacher's voice at the same amplified level throughout the classroom. Every child hears the teacher at the same level no matter where the child is seated.

## 30% of K-6 Children Hear Their Teacher Significantly Better

The U.S. Department of Education has validated in an extensive series of studies (conducted from 1971 to the present) that approximately 30% of any K-6 population will have ear infections and middle ear fluid throughout the school year. These common middle ear conditions produce a mild hearing loss (MHL) of 10 to 20 decibels. Without intervention, 70% of these MHL children will become academically deficient in at least one or more subjects by the 6th grade.<sup>(4)</sup>

The U.S. Department of Education has validated that classroom audio in the classroom can overcome the hearing loss of MHL children and with classroom audio these children are enabled to academically perform as well as children with normal hearing.

## Attention & On-Task Time Improve

One of the most common difficulties for children in listening is distraction. A student sees a movement in his peripheral vision, a child at the back of the classroom may hear a chair move next to her as loud as the teacher's voice. The result in either case may be the loss of a word or a concept. A child's sensitivity to distractions can vary day-to-day and even hour-to-hour. In addition, the average classroom today will have several children with some type of learning difficulty; one of the most significant is Attention-Deficit Disorder (ADD).

It is now known that classroom audio can in many cases reduce a child's sensitivity to distractions. When a teacher's voice is amplified 5 to 15 decibels above ambient noise, improving articulation and enhancing speech intelligibility, the amplified instruction can better capture a child's attention and tends to suppress their sensitivity to the normal sounds and movements within the classroom. Teachers using classroom audio report less repeating of instructions is necessary and fewer reminders are needed.<sup>(5)</sup>

## Class Interaction & Participation Increases

Children who cannot hear and understand clearly what they are being asked and told, often lack the confidence to participate in classroom discussion. The MARRS studies show clearly that a significant number of K-6 children cannot hear adequately due to poor classroom acoustics, high ambient noise levels, and high incidence of mild hearing loss. When a child cannot hear instructions well, the uncertainty of what is happening can cause reluctance to being involved.

Teachers employing classroom audio in the classroom note an improvement in student motivation and participation due to more consistent understanding of what is expected. They also report a marked improvement in responses to questions and requests. In classrooms where students used the microphone to amplify their voices, teachers report increased enthusiasm and desire to read and give oral reports.<sup>(6)</sup>

## Classroom Stress is Lowered & Fewer Behavior Problems

Educational psychologists have known for some time that as a teacher raises his/her voice level, the tension and anxiety among children in the class is heightened. The prime example is when a teacher needs to raise their voice in a forceful manner to get the attention of a child misbehaving in the back of a classroom. All the children feel the stress of such a verbal encounter. It is also well known that a loud, forceful command for some children can have the opposite response to the desired behavior. In general, children are known to respond best to a natural, conversational voice level.

Classroom Audio allows a teacher to speak in a natural conversational voice level and still be heard clearly. Teachers report a significant reduction in stress within the classroom, fewer behavior problems, better response to verbal correction when necessary and overall easier management/control of classrooms.<sup>(7)</sup>

**Classroom Audio  
Technology has been  
defined as... "A speech  
intelligibility system  
that provides clarity  
of voice and even  
sound distribution  
throughout the learning  
environment."**

*—Lightspeed Technologies  
web site.*

“In classrooms where students used the microphone to amplify their voices, teachers report increased enthusiasm and desire to read and give oral reports.”

—Allen and Patton(6)

### **Teacher Absenteeism Due to Voice Fatigue & Throat Illness Is Almost Eliminated**

Voice fatigue and throat infections account for 11% to 16% of teacher absenteeism. Even in a classroom with relatively low ambient noise a teacher must project his or her voice to overcome the normal physics of sound travel through air. The inverse square law of physics defines that for every doubling of the distance from a teacher, their voice level drops by 75%. This means a student seated at 12 feet from the teacher hears the teacher’s voice at less than one-eighth of the level of a child seated three feet away from the teacher. In order to overcome this loss of voice level over distance, many teachers have to project their voices well above a natural and healthy level for their vocal cords. This results in higher than average throat/voice problems for teachers.

With the use of classroom audio a teacher is able to speak in a conversational voice, all students hear them easily, and most, if not all, voice strain is eliminated. The outcome is that schools using classroom audio report significantly lower teacher absenteeism (8% to 13% lower) due to voice and throat problems.<sup>(8)</sup>

### **Academic Test Scores Improve**

The MARRS study clearly proved that classroom acoustics, ambient noise and mild hearing loss have a significant affect on the academic performance for 25% to 30% of K–6 populations. What has been overlooked until recently has been the impact of classroom acoustics and ambient noise on children with normal hearing.

Sound-field studies show that amplifying a teacher’s voice results in exceptional improvement in reading and language test scores for all students at all elementary levels. It has reduced special education referral rates by up to 40% over five years. Some studies have a shown a 7% to 10% improvement in academic test scores for normal hearing children. The statistically significant gains that have been made employing classroom audio have usually been evident in less than one full school year, and have been maintained in research study periods for up to three years.<sup>(9)</sup>

### **Children for Whom English Is A Second Language Can Experience Over 30% Improvement In Word/Sentence Recognition**

A 1994 study shows that noise in the classroom has a substantial negative impact on English Language Learners students when compared with native language students. At 18 feet from the teacher the ELL student scores 25% lower than native language children.

A recent study shows that ELL students can score as much as 30% higher on word/sentence recognition tests when classroom audio is in use. <sup>(10)</sup>

### **Children With Other Learning Disorders Can Benefit**

Several studies show that children with articulation disorders (5%–10% of all school age children), language disorders, auditory processing disorders, learning disorders, and unilateral sensorineural hearing loss all experience more severe speech recognition difficulties as the voice to noise level decreases (greater distances from teacher).<sup>(11)</sup>

Although there is not as much empirical data to support improvement due to sound-field classroom audio, improved voice to noise ratios have proven to help many of these children.

### **Teacher Survey Shows Classroom Audio Systems Perceived More Useful Than Most Popular Audio/Visual Equipment**

A survey of ninety school teachers ranked the importance of the most popular equipment used in class instruction. The equipment list included: cassette tape player/recorder, overhead projector, television, classroom audio system, camcorder, TV/VCR combo, and CD-ROM.

Those teachers who had used classroom audio gave it twice the #1 votes over the next most useful equipment.<sup>(12)</sup>

**“For the first time in my career, I have energy at the end of the day”**

**—Ms. Miyahira  
2nd grade teacher,  
Tigard, OR**

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Established in 1990, Lightspeed Technologies is the trusted provider in classroom audio technology. Our passion is to improve the listening and learning environment for every child. We believe strengthening the connection between teachers and students is at the heart of learning.

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