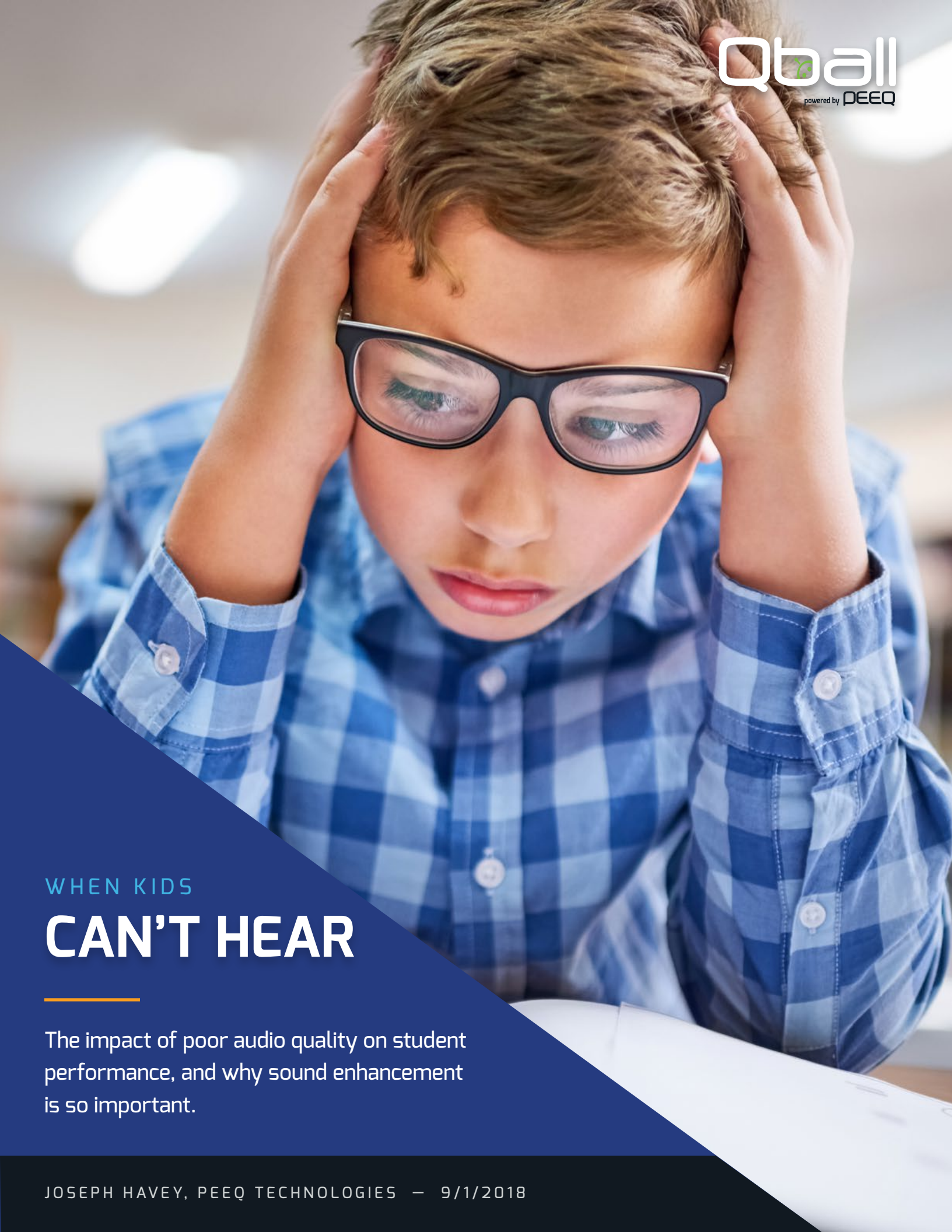

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WHEN KIDS

CAN'T HEAR

The impact of poor audio quality on student performance, and why sound enhancement is so important.

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Have you ever been to a lecture or presentation where you couldn't quite hear what the speaker was saying? Instead of soaking up the learning experience, the situation forced you to spend your mental energy deciphering the words. If it was really bad, you probably just pulled out your phone and began poking through email. Better to wait for the post-event PowerPoint slides.

There are few things more annoying than being in an audience unable to hear. While adults rarely find themselves in this situation post-college, school-age children can potentially experience this frustration every day, leading to negative consequences such as disengagement and lowered motivation. Research indicates 60 to 75 percent of the school day consists of listening-based activities[1], meaning a child's negative experience can have a huge impact on his/her performance.

This white paper discusses the source of the poor-audio problem, its effects on student performance, the reasons "talking louder" will not solve the issue, and why sound enhancement has been shown to be an effective solution, raising student test scores and saving school dollars.

60-75%

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THE PROBLEM:

Poor Sound Quality in the Classroom

Walking into a well-designed auditorium, you will notice it is set up differently from most rooms. First of all, it is big – with high ceilings and many rows. Second, it is not square, with walls that angle outward from the stage or pulpit. Finally, it is covered in sound-absorbing material, such as carpet and padded seats.

None of this is by accident. In one way or another, these features contribute to better sound quality. It is a contrast to many classrooms, which include flat, hard walls, linoleum floors and square configurations. The typical classroom design may be useful for keeping things clean, but it is terrible for sound management. Hard surfaces bounce sound around the room, causing unnecessary nulling (a sound cancelled by its own echo) or reverb[2].

Additionally, background noise in the classroom can be relentless. Not just limited to jets, traffic or lawn equipment, ambient noise also includes air conditioners, computer whirring, projectors, squeaking desks and sounds coming from other rooms.

Compounded, these effects make it difficult to hear the subtle differences between sounds such as “s,” “sh” and “ch,” or between “b,” “m” and “n.” Worse still, children do not develop the cognitive ability to use context to decipher meaning until about age 14. In other words, if a class of first-graders hears “my very educated mother just served up nine pizzas” as “Ny very educated mother just served up mine pizzas,” they won’t know to filter out the words “Ny” and “mine” with “my” and “nine.”Just like that, Neptune and Mercury have switched places in the solar system.

This inability to filter means children need to hear things more clearly. On a more technical level, adults with normal hearing require a speech-to-noise ratio (SNR) of approximately +6 decibels in order to hear the spoken message as consistently intelligible. Given the decibel scale is logarithmic, a +6-decibel SNR means the voice needs to be about 50 percent louder than background sounds. Children, however, require an SNR of approximately +15 dB to +20dB. For them, the desired signal needs to be up to 300 percent louder than background sounds[3]!

For comprehension, children require sound to be

300% LOUDER

than background noise.

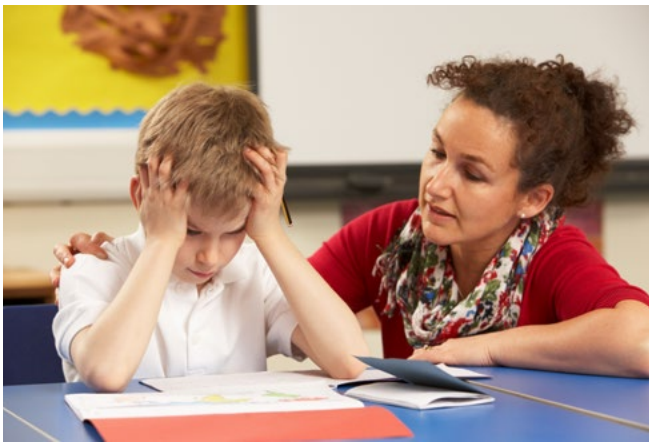
Without the ability to hear, school children face some pretty unpleasant consequences. As reported in a 2013 study in the Journal of Urban Health, scientists found that 8- and 9-year-old students who experienced higher “ambient” noise levels in school performed significantly worse on standardized tests in mathematics and French language, after controlling for their socioeconomic backgrounds[4].

Other studies have shown similar results:

- Exposure to ambient noise is associated with small, negative changes in children’s mental health and classroom behavior[5].
- Children in noisier areas show elevated resting systolic blood pressure and 8-h, overnight urinary cortisol[6].
- Indoor noise and reverberation in classroom settings are associated with poorer performance of verbal tasks[7].

If they cannot hear their teacher, it is a stressful experience. Either you will strain harder to understand the lecture, as many children do, or you will give up and tune out. Neither situation

is optimal.



Many teachers recognize the need to increase their volume (not only increase it, but really increase it) and attempt to raise their speaking voice to compensate. However, as the next section describes, this cannot be a long-term solution because it places unhealthy strain on the teachers' vocal chords.

THE WRONG SOLUTION:

Why Talking Louder Doesn't Work

When we break down the math, it is a bit shocking to discover the necessary volume needed to reach an optimal signal-to-noise ratio in the classroom. As mentioned above, most school-age children need the teacher's voice to be at least 15 decibels louder than background noise. The average ambient noise level for most classrooms is 50 decibels, meaning a teacher's voice must reach 65 decibels or louder. Although 65 decibels is the volume of a conversational voice, the label "conversational" assumes that the receiver is within two to three feet from the speaker. To account for students in the back row, the teacher would need to raise her voice up to 83 decibels for everyone to hear[8]. This is quite loud – about as loud as a garbage disposal[9]!

Aside from the fact that most teachers will never raise their voice to this level, speaking at any volume higher than a conversational tone is both unnatural and unhealthy. Research shows it can cause a host of problems:

- While teachers make up only about four percent of the working population, they compose about 20 percent of the patient population in voice treatment centers[10].

- Also, teachers are 32 times more likely to be plagued with voice problems than any other voice-dependent occupation[11].

Of course, teachers are not the only ones who need to be heard in the classroom. Children naturally speak at lower volumes than adults, and when students ask questions, it becomes that much harder for anyone to hear.

THE RIGHT SOLUTION:

Sound Enhancement

At this point, it is clear research supports poor audio quality negatively impacts student performance. Teachers compensating by raising their voice is not realistic, and potentially harmful to the instructor.

Possible fixes that do work include the installation of carpets and other sound-dampening materials, such as curtains. Additional attempts to lower ambient noise, such as requests that grounds maintenance happen during lunch or weekends, help as well. However, the worst elements of poor acoustics, such as bad classroom design, are often out of anyone's control. Instead, a more available fix is to raise the volume of the teacher, in a healthy way that makes sense, such as through sound enhancement.

In a sound-enhanced classroom, the teacher's voice is spread evenly, meaning there is no difference in volume between the front and back of the classroom. Additionally, the sound is distributed mechanically so the instructor does not have to raise his or her volume above what is considered conversational. Not only is this more pleasant for students to hear (as the teacher is not shouting), it also is much healthier for the teacher's voice.

Does it work? Study after study has shown the answer is a resounding "yes."

- A 2003 study shows the Stanford Achievement Test scores of students in amplified classrooms were 10 to 15 percent higher than students in unamplified classrooms[12].

- In 2004, researchers in Oregon showed that students in amplified classrooms scored an average of 35 percent higher on the Dynamic Indicators of Early Literacy Skills (DIBELS) and an average of 21 percent higher on the Developmental Reading Assessment (DRA) than students in unamplified classrooms[13].

SAT test scores were 15% higher, DIBELS scores were 35% higher, and DRA scores were 21% higher in amplified classrooms.

- Studies have also linked sound amplification with improved student behavior, motivation

and general engagement in classroom activities[14].

- In 1996, Dubuque Community School District in Iowa reported teachers in classrooms without sound enhancement averaged fifty-two sick days per year due to voice, jaw or throat problems (0.93 sick days per teacher). However, teachers in sound enhanced classrooms took only nineteen sick days per year (0.34 sick days per teacher) for the same problems[15].

That last bullet is especially notable because it is evidence for cost savings. At $100 per day for substitute pay, a sound enhancement system (like the Qball, only $179) can pay for itself by preventing just 2 days of teacher absences.

CONCLUSION:

Sound Enhancement is Better for Students, Better for Teachers, and Better for Your Budget

Noise in the classroom can present huge problems for a students' ability to learn and a teacher's vocal health, lowering test scores and teacher attendance. There are several solutions a school can implement to improve the auditory environment, but amplification is one of the most impactful. Making a small investment in an amplification system has the potential to save money in the long run by preventing teacher absence. Not only does this allow students to hear the teacher more clearly, but also has the potential to allow students to hear other students better. It reduces strain on teacher's voices, provides a more comfortable learning environment, and often leads to an increase in student test scores.

THE QBALL:

Affordable Sound Enhancement

Does sound enhancement sound like the right step for you? With so many options today, it can be hard to know how to choose. However, of all the choices available, Qball is the most affordable, costing only half as much as its competitors. Plus, the Qball is a fun way to engage your students (and protect your teachers!).

Visit www.buyqball.com to learn why Leslie Fisher, over 8,000 classrooms, and over 150,000 students trust the Qball.

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