



Multi Comfort

BY SAINT-GOBAIN

The Importance of Acoustics & IAQ in Efficient Learning

Jason Hird - Saint-Gobain Gyproc
23 April 2019 - 9:00 to 11:00



SAINT-GOBAIN

INTRODUCTION TO SAINT-GOBAIN GROUP

2018 net sales

\$47 BN

More than **180,000** employees
and **100+** nationalities
represented

Present in

67 countries

More than **80%** of sales
are made in the habitat markets:
construction, renovation,
infrastructures and civil
engineering



More than **4,100**
sales outlets

Created more than
350 years ago

One of the top **100** industrial
groups in the world with around
950 production sites



MAJOR BRANDS

Main businesses

Building glass



Plasterboard and Gypsum



Insulation



Acoustic ceilings



Complete pipe systems



Renders and mortars



Technical textiles



Interior and exterior Solutions



Automotive glazing



Abrasives



Specialist brands

Electrochromic glass



Window film



Architectural Membranes



Fire resistant glass



Bearings



Flexible tubing



Refractories



Polymer seals



Adhesive foams



Ceramics for energy





**How important is
acoustics & indoor air quality
in our schools?**



World Health Organization

- ❑ Noise is the second largest cause of health problems after air quality
- ❑ Evidence indicates that those chronically exposed to high levels of environmental noise have increased risk of cardiovascular diseases
- ❑ Noise pollution is considered a threat to public health
- ❑ Exposure to excessive noise reduces the cognitive ability in school-age children and impairs their learning

Source: World Health Organization European Commission Publication – Burden of disease from environmental noise. Quantification of healthy life years lost in Europe.

How noisy are schools?

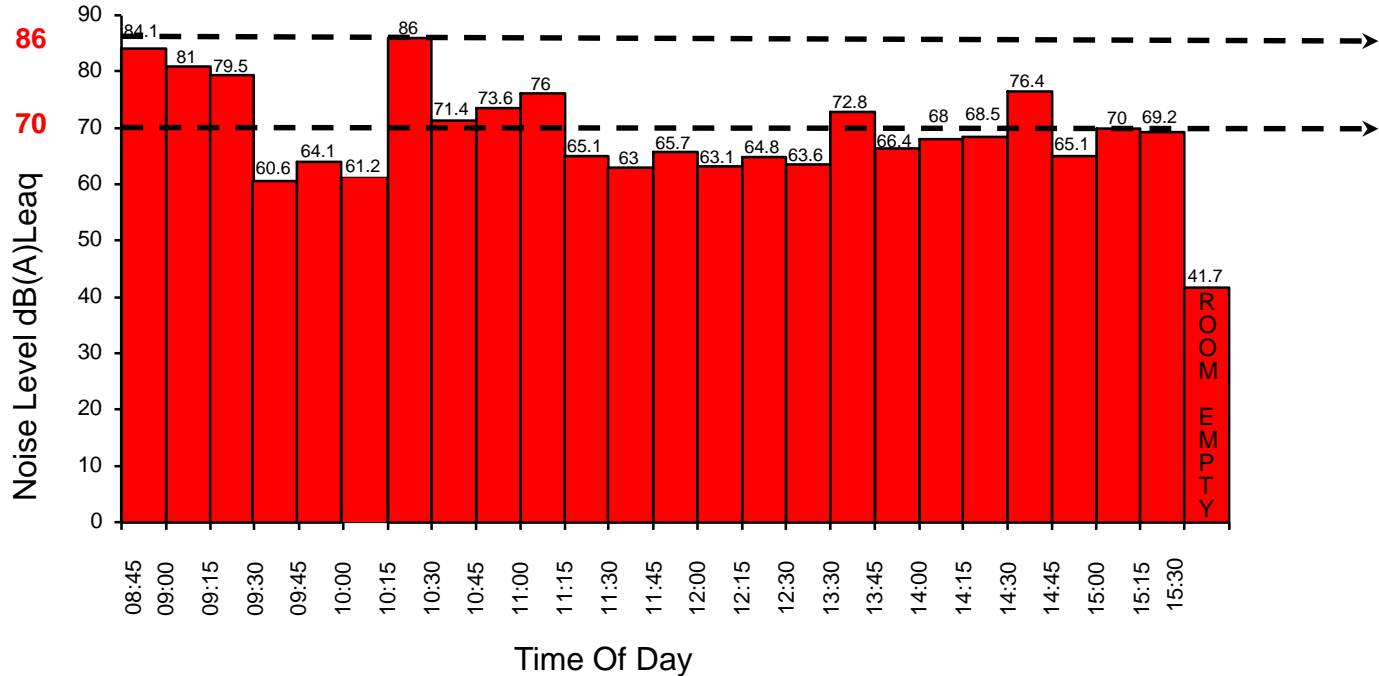


Where does 'noise' in education come from?

1. Multiple & competing classroom discussions
2. Sports activities
3. Movement of chairs and equipment
4. Noisy corridors and dining areas



Background noise levels in dB (decibels)



Average measured level throughout the day = 70 dB

Source: Heriot-Watt University Study

Excessive noise levels in schools

75dB

Children's hearing risks being damaged at noise levels exceeding 75 Decibels (dB)

85dB

Employers must provide hearing protection and hearing protection zones at 85 Decibels (daily or weekly average exposure)

Room/space	Activity	Sound level
Sports hall	games	89 dB(A)
Corridor	break	85 dB(A)
Classroom	lesson	86 dB(A)

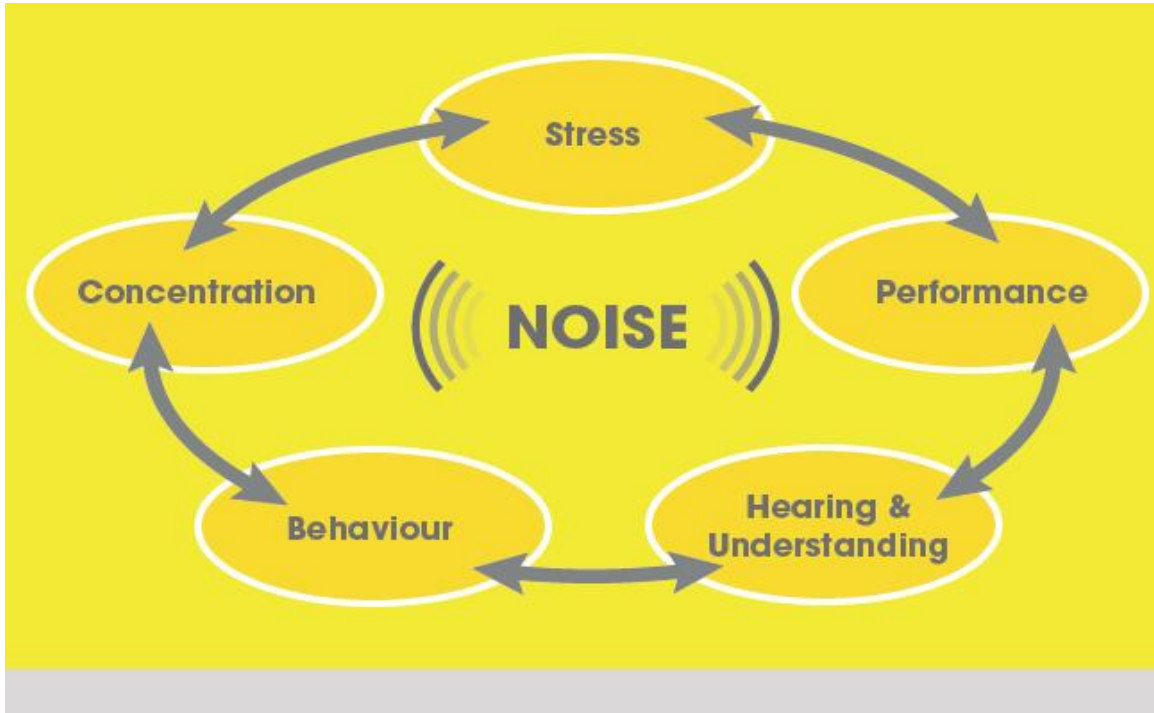
Examples of excessive sound levels in schools. Source: Polish Association of Health Education. Publication: Eco Education

WHY IS NOISE CONTROL SO IMPORTANT?

Scientific studies prove that noise levels have a **significant effect** on **educational achievement**



All children are affected by poor classroom acoustics



- ❑ Visually impaired
- ❑ Learning difficulties
- ❑ Behavioral problems
- ❑ Hearing loss, either permanent or temporary
- ❑ Children who speak multiple languages

Key parameters for good room acoustics



Reverberation time



Speech Clarity



Reverberation

The speed at which sound energy disappears in a room

Long reverberation times:

- No acoustic treatment
- Rooms with hard / reflective surfaces
- Rooms that ‘echo.....echo.....echo’
- Makes hearing & understanding speech difficult
- Can contribute to high noise levels



Reverberation

The speed at which sound energy disappears in a room

Short reverberation times:

- Acoustic treatment
- Room seems to be quiet and calm
- Easier to hear and understand speech clearly
- Can help to reduce noise levels



Reverberation

The speed at which sound energy disappears in a room

Long/High reverberation – No acoustic treatment



Reverberation

The speed at which sound energy disappears in a room

Short reverberation - acoustic treatment

Understanding Speech – Speech Clarity



Vowels and Consonants

There are 26 alphabets divided into 5 vowels (a,e,i,o,u) and 21 consonants (remaining alphabets.)

A vowel is a speech sound made by allowing breath to flow out of the mouth, without closing any part of the mouth or throat.

Vowels A E I O U

A consonant is a speech sound made by partially or completely blocking the flow of air through the mouth.

Consonants B C D F G H J
K L M N P Q R
S T V W X Y Z

www.englishmirror.com

- ❑ Vowels create the sound volume of speech
- ❑ Consonants are the bearers of information

Speech clarity

Concerns the quality of speech transfer to the listener

Unclear Speech:

- Words reverberate and get 'mixed up'
- Consonant letters are lost at certain frequencies
- Difficult to hear and understand speech





Speech clarity

Concerns the quality of speech transfer to the listener

Clear speech:

- Words are easy to hear and understand
- Makes it easy to follow instructions
- Good Speech Intelligibility

Speech intelligibility

- ❑ Research shows that children sat in 'dead spots' in a classroom can have a 100% loss consonants
- ❑ These children would only hear the vowels in speech
- ❑ They cannot understand what the teacher is saying

Source: Heriot-Watt University Study

100% loss of consonants

-o-e --a---oo-- -a-e -oo- a-ou--i--



100% loss of vowels

s-m- cl-ssr--ms h-v- p--r -c--st-cs





Good speech intelligibility

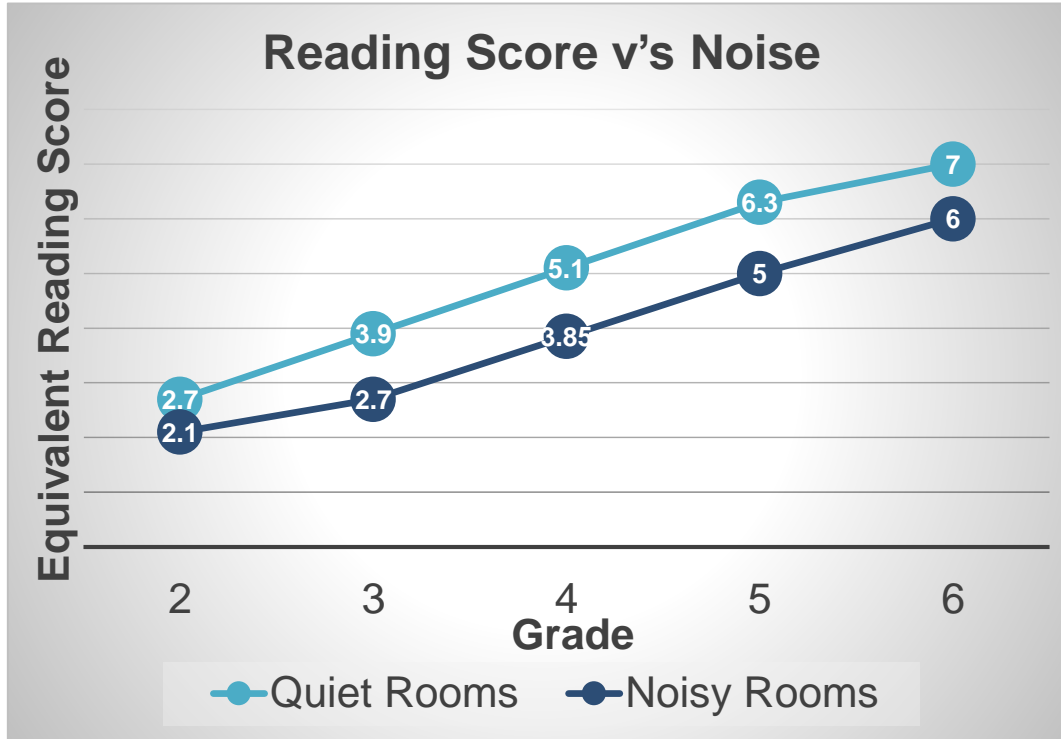
some classrooms have poor acoustics

Poor acoustics have a negative effect on educational achievement



- ❑ With better speech clarity there is a 25% greater understanding of speech
- ❑ With good acoustics there is a 5-7% better result in test scores

The impact of acoustics on reading development



- Children reading in a noisy environment were 1 year behind developmentally to those reading in quiet environments

Reference: Sutherland.L, Lubman D., 2001

The story of Midas and his drawings



- ❑ Danish ADHD (Attention Deficit Hyperactivity Disorder) Association
- ❑ Midas was asked to do his favourite drawing
- ❑ Classroom was asked to be silent

The story of Midas and his drawings



- ❑ Midas was asked to draw the same picture a second time
- ❑ The other pupils could talk but not to Midas
- ❑ Same drawing in a noisy environment

Comparison of the drawings

Quiet
Environment

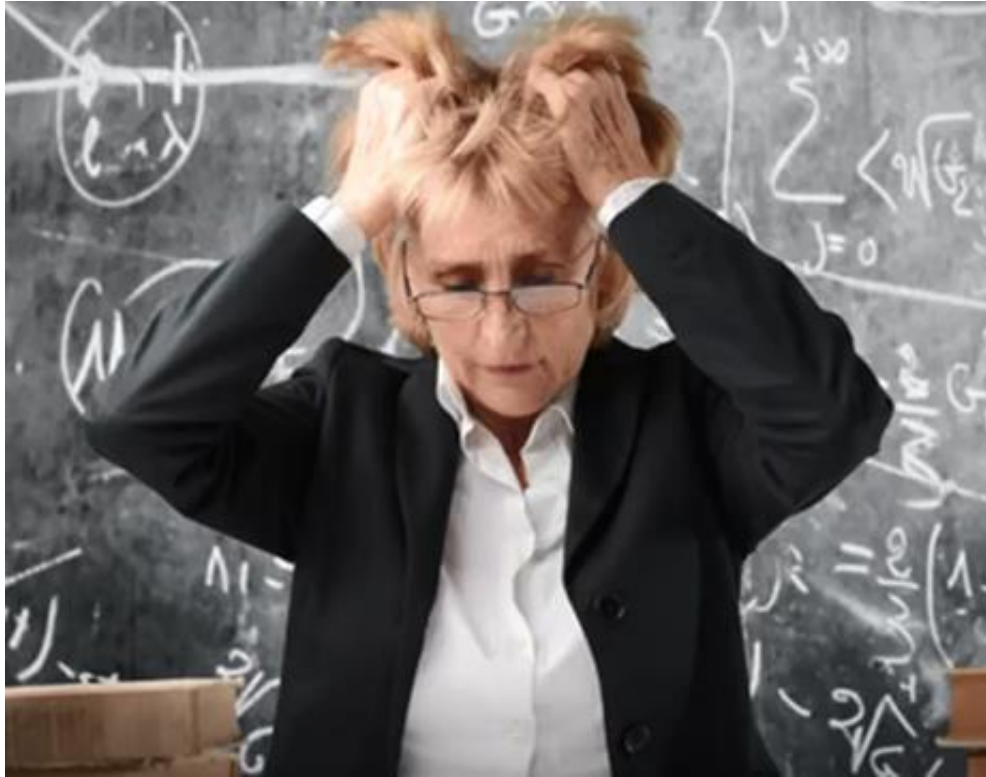


Noisy
Environment

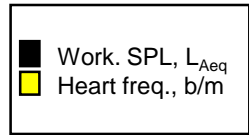
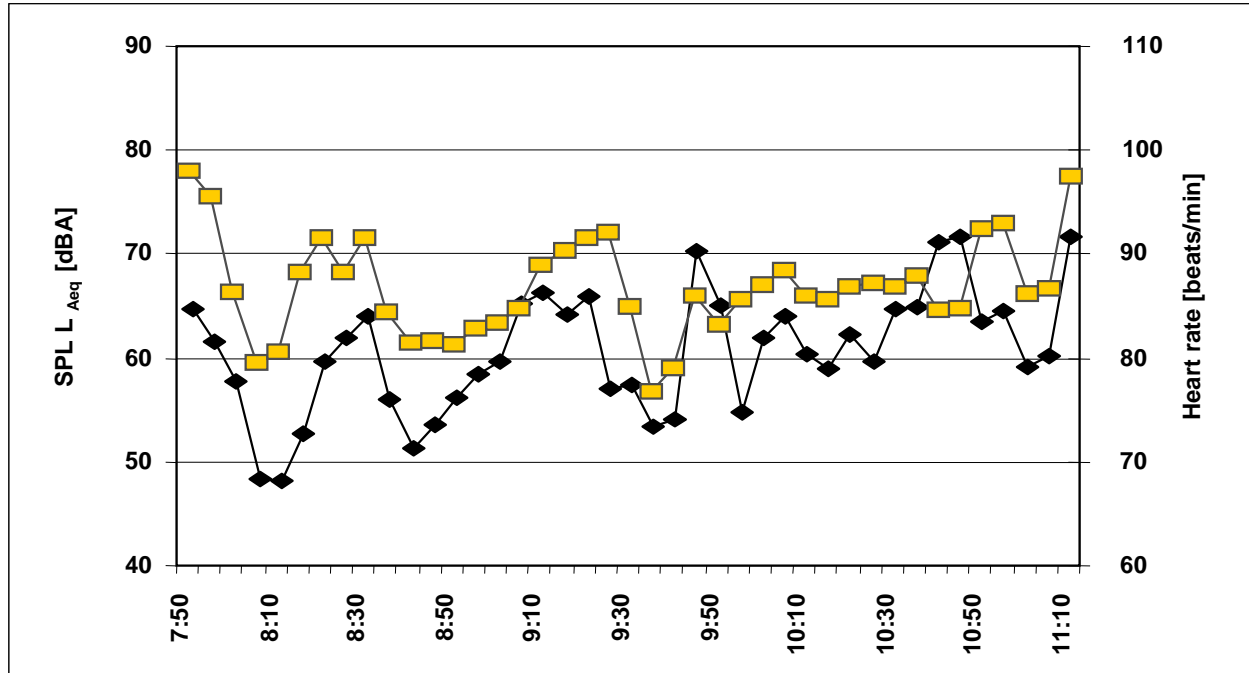


Pictures from 'Sound Education Seminar', Camilla Lydiksen, CEO ADHD-foreningen

The effect of excessive noise on teachers



Working Sound Pressure Level (SPL) and average Heart Rate_{5min} of the teacher



Source: Saint-Gobain Ecophon & University of Bremen

Teachers working in a good acoustic environment..



- ❑ Can work with a relaxed heart rate for more than 80% of the time (it was just 60% in the noisy environment)
- ❑ Can reduced their heart rate by 10 beats per minute
- ❑ Took less days off sick
- ❑ Suffered less voice and throat problems
- ❑ Suffered less head aches

FOUR FEATURES FOR HEALTHY, GREEN SCHOOLS



1. INDOOR AIR QUALITY & VENTILATION



Every **100** parts per million increase in CO₂ was associated to a roughly **one-half day per year reduction in school attendance**¹

2. DAYLIGHTING & LIGHTING



Students in the US showed a **36%** increase in oral reading fluency when exposed to high-intensity light, while those in standard lighting conditions increased by only **16%**²

4. NOISE & ACOUSTICS

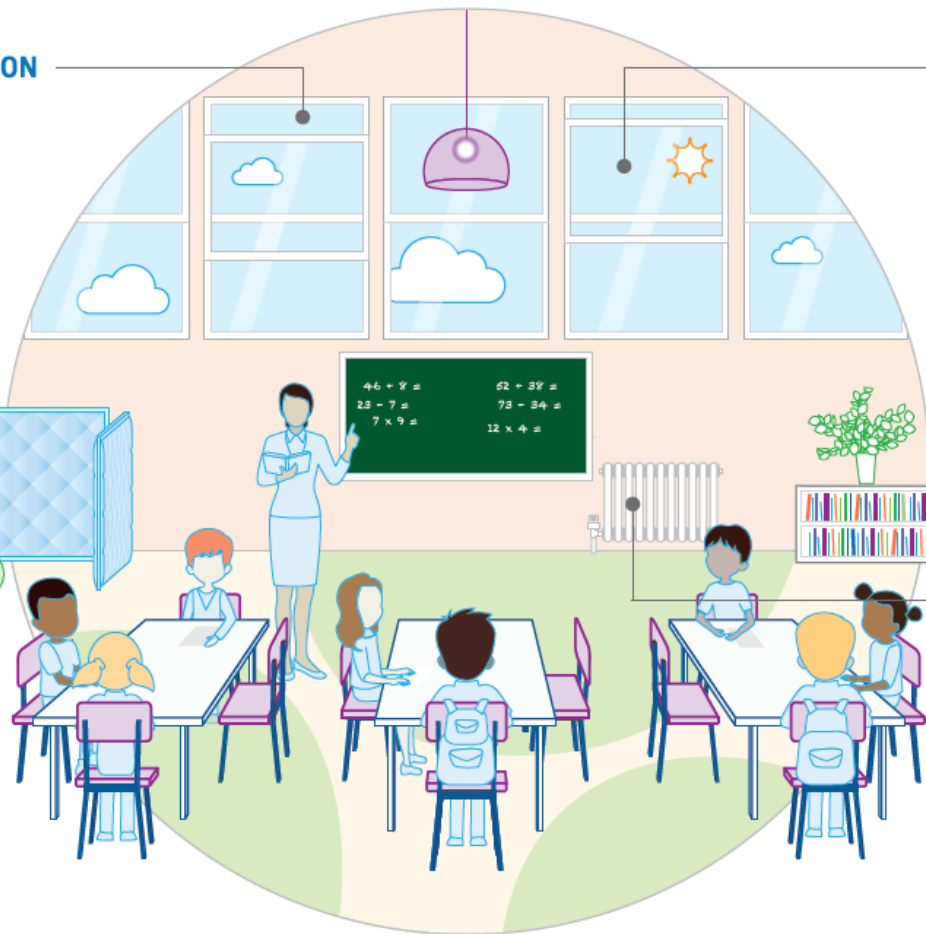


Noise can hurt test scores: for every **10** decibel increase in noise, the language and math scores of French students decreased by **5.5 points**⁴

3. THERMAL COMFORT



Students citing their classroom as 'comfortable' achieved **4%** more correct answers in a math test compared to those who were hot³



Acoustics in Schools



WorldGBC believes in green buildings for everyone, everywhere. Schools are no exception. We call for schools that are energy efficient, have low greenhouse gas emissions, and schools which are designed and operated for children's health, wellbeing and performance.

To help, Better Places for People has produced a series of briefing notes, focusing on four features of indoor environmental quality. These are intended for school board decision-makers, as well as school designers and facility managers, to share how design and operation features affect students' health and, in turn, their academic performance. By combining health, wellbeing and low carbon operation, we can ensure students spend their days in truly green school buildings.

PROBLEM:

Poor acoustics in schools can negatively affect children's health and academic performance.

SOLUTION:

Thoughtful school design and operation can improve acoustics and improve student health and performance. This can also most often be done without increasing greenhouse gas emissions.

What are acoustics?

Acoustics, or noise are typically measured using:

- + The **background noise level**, measured in decibel (dB)
- + **Reverberation time**, which measures the time a sound can travel in a room (a low reverberation time is desired to minimize echo and disturbances).



Acoustics affects children's health and comfort

Poor acoustics in classrooms can directly impact student health and behaviour: 2



Hearing Loss



Changes in Heart Rate



Higher Blood Pressure



Decreased Wellbeing & Higher Stress Responses



Attention Deficit Hyperactive Disorder (ADHD) & Aggressiveness



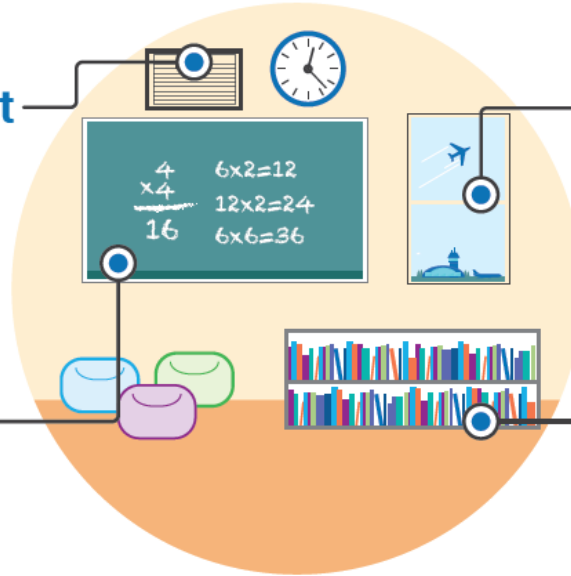
Sleep Disturbance, Fatigue & Irritability

Acoustics affects children's performance at school

Internal sources of noise

↓ **Lower student achievement**
scores were recorded in Florida schools with loud HVAC systems compared to students in quieter classrooms **3**

✎ **For every 10-dB increase**
in noise, the language and math scores of French students decreased by 5.5 points **4**

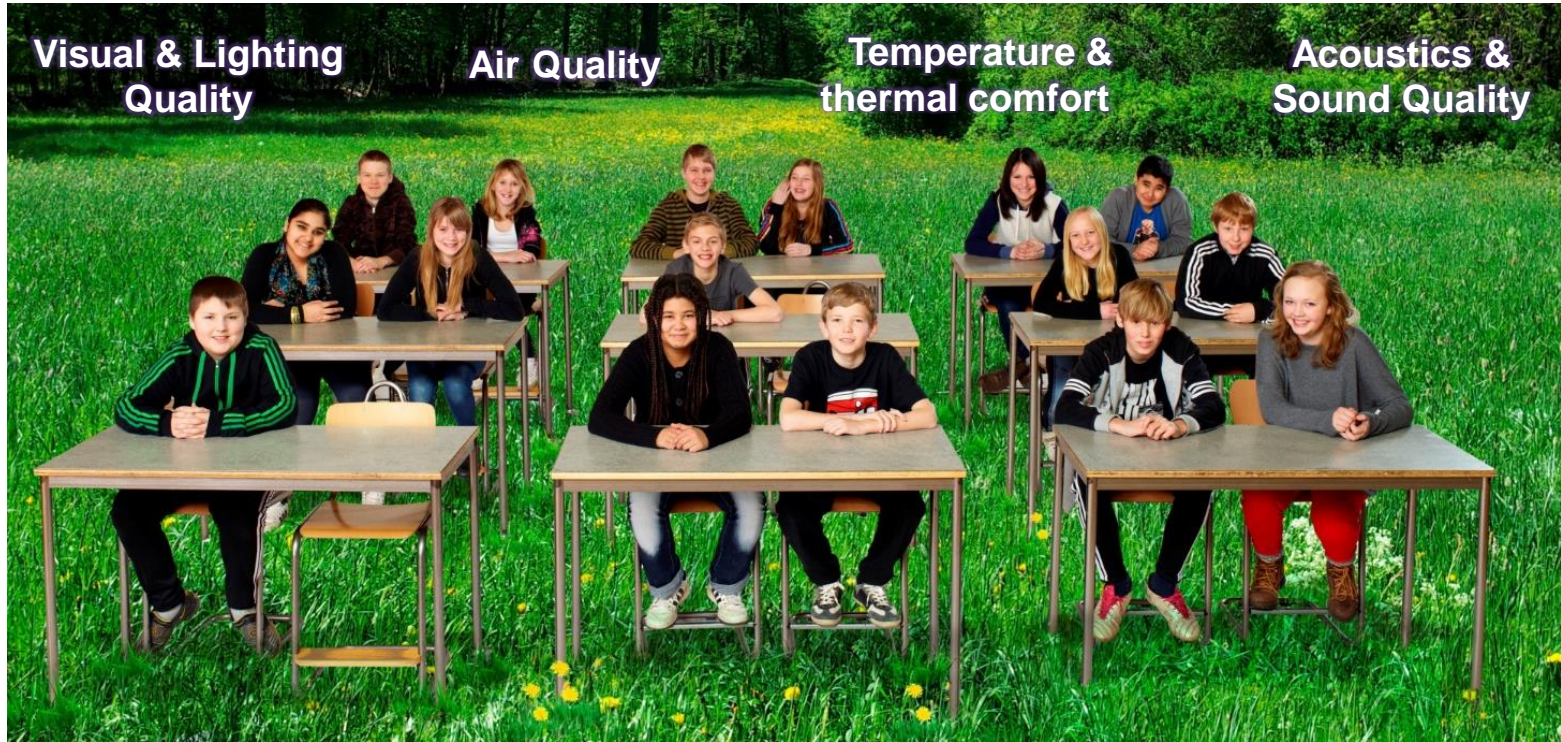


External sources of noise

⋯ Students in a UK school located in a flight path misheard **1 in 4 words**, affecting language acquisition skills **5**

↓ **Lower reading levels**
were recorded in students located near a major New York airport **6** and London's Heathrow Airport, compared to those in a quieter location **7**

The natural sound environment supports teaching and learning







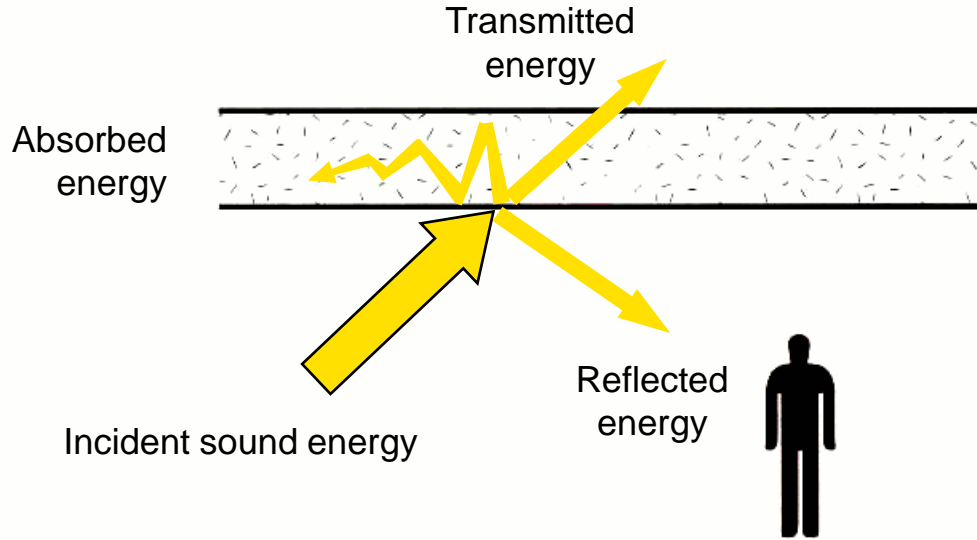




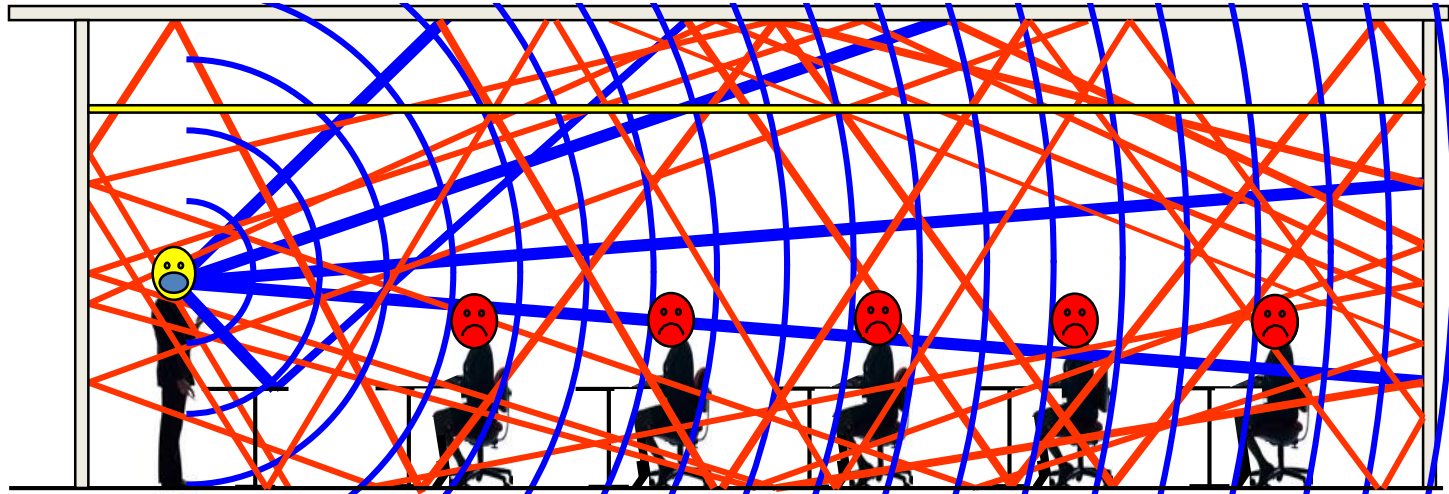




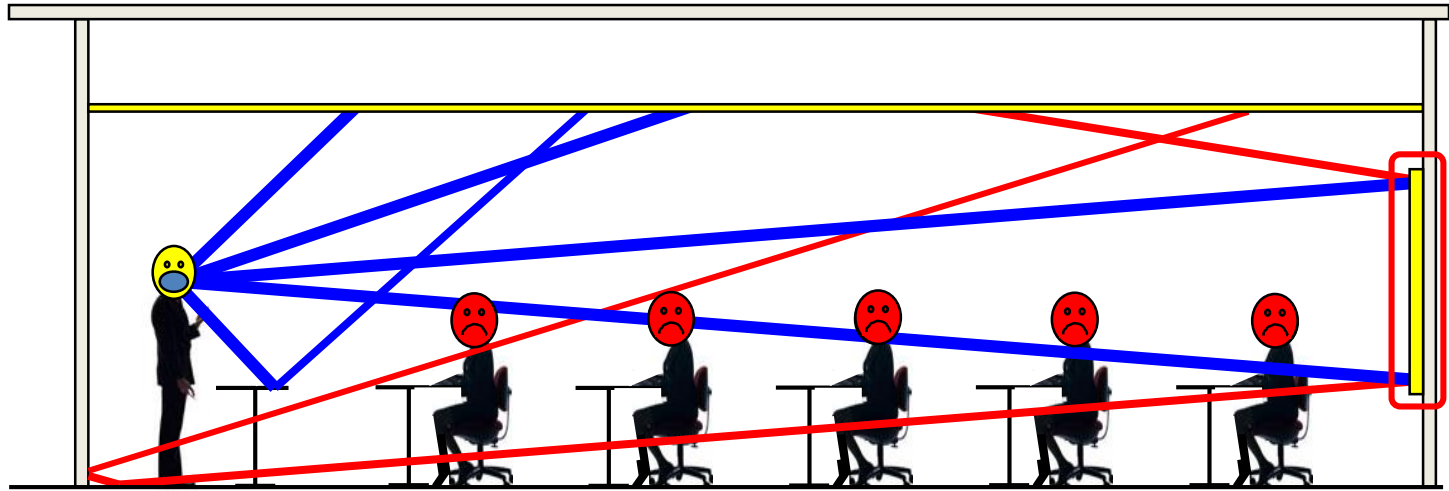
Use a sound absorbing material



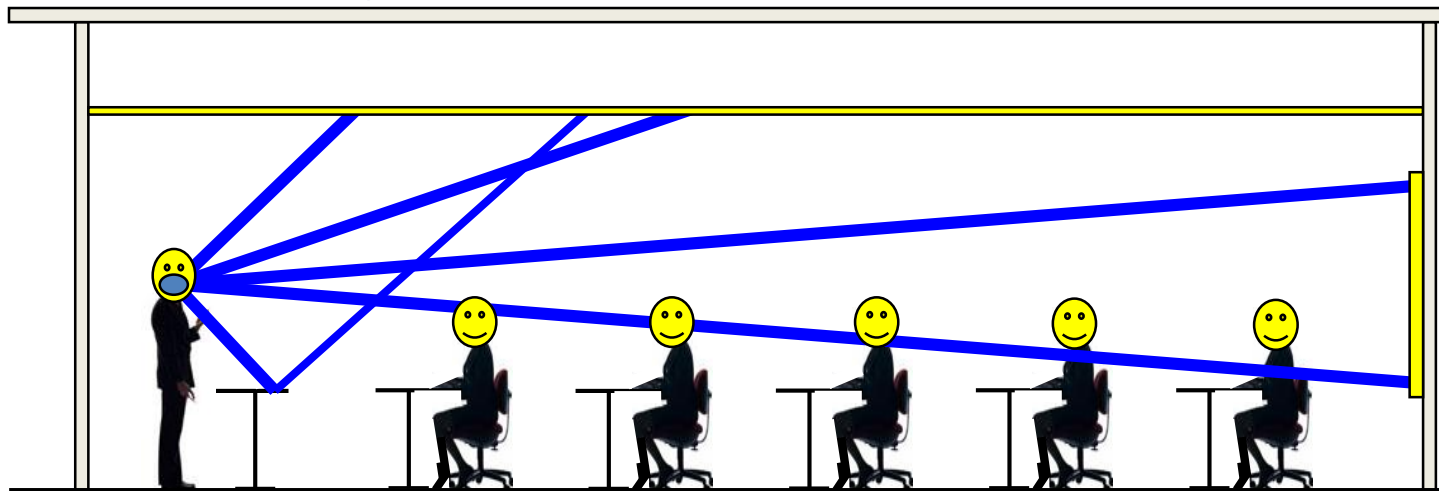
Bring the outside environment inside



Bring the outside environment inside



Bring the outside environment inside

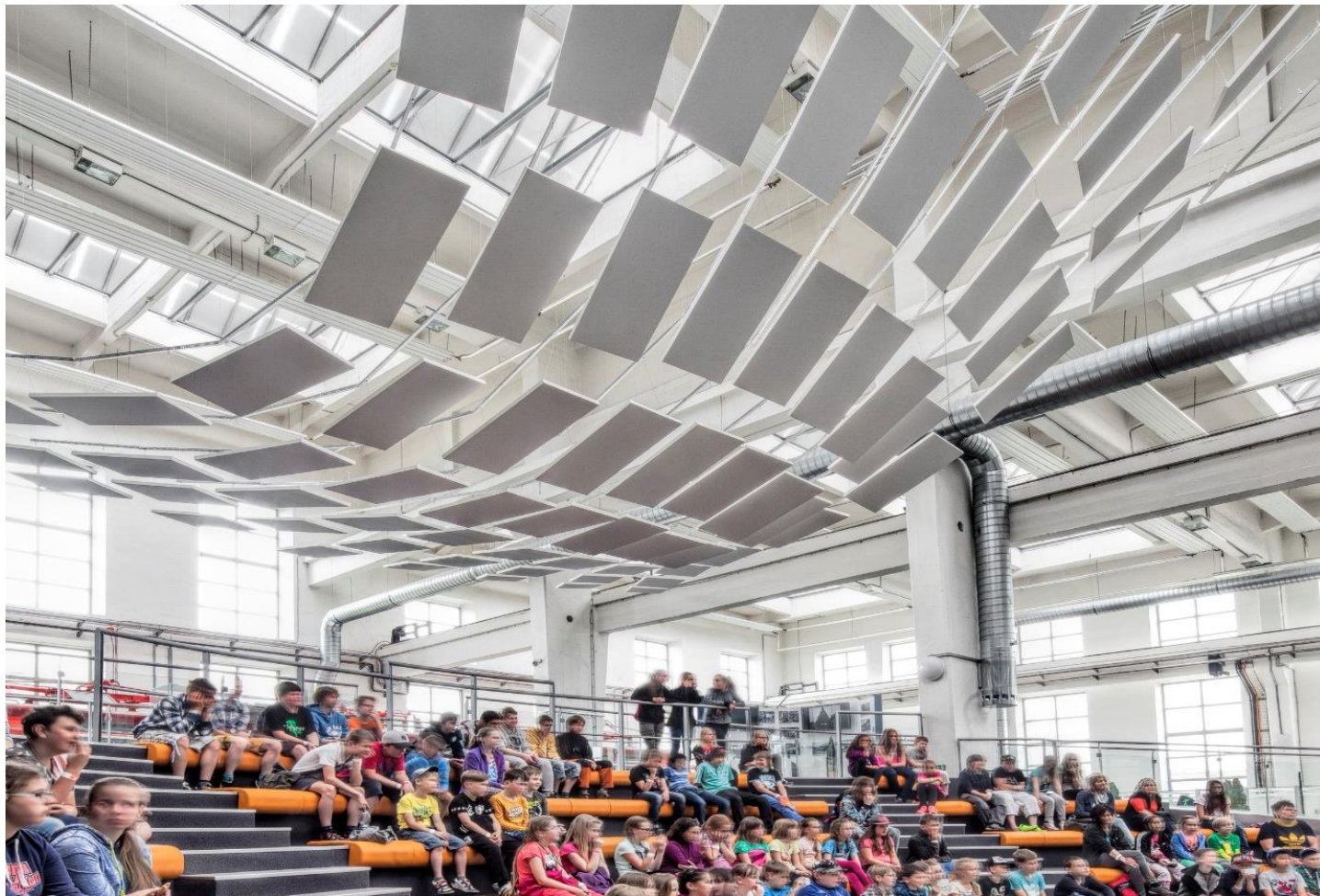


What is the solution?





- ✓ Give every child the best conditions for learning and for personal development
- ✓ Empower the teacher, reduce vocal stress
- ✓ Students' results for reading and learning are directly correlated to background noise levels





Acoustic solution:
Ecophon Focus™ Ds and
Ecophon Solo™ Square

Classroom



Acoustic solution:
Ecophon Solo™ Freedom

Children's Creative Center



Acoustic solution:
Ecophon Master™ Matrix

Lecture Theatre



Acoustic solution:
Ecophon Solo™ Square

University Cafe



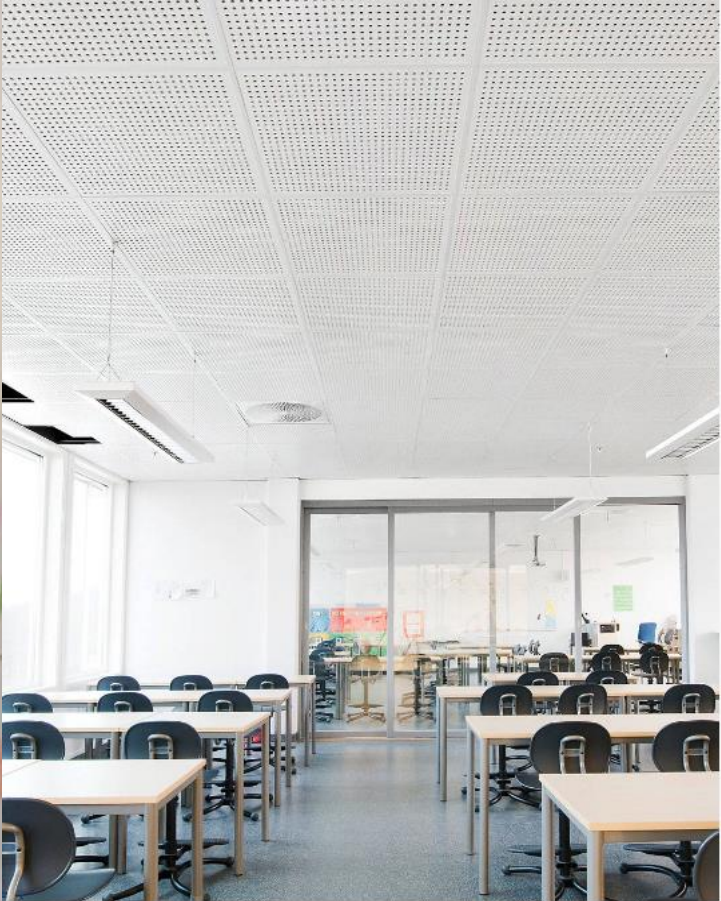
Acoustic solution:
Ecophon Solo™ Baffle in
Colour S 2050-B

University Break Out Area



Acoustic solutions:
Ecophon Super G™ A

Sports Hall



Class Rules

- Listen
- Have all the necessary equipment
- No toilet break during lessons
- Fix what you break
- Take pride in your work
- Respect

Michael
Jacob
Harry
Matt &
Lucy
Eliote

Untreated

times tables



sound
education

www.soundeducation.tv

TRIANGLE NUMBERS

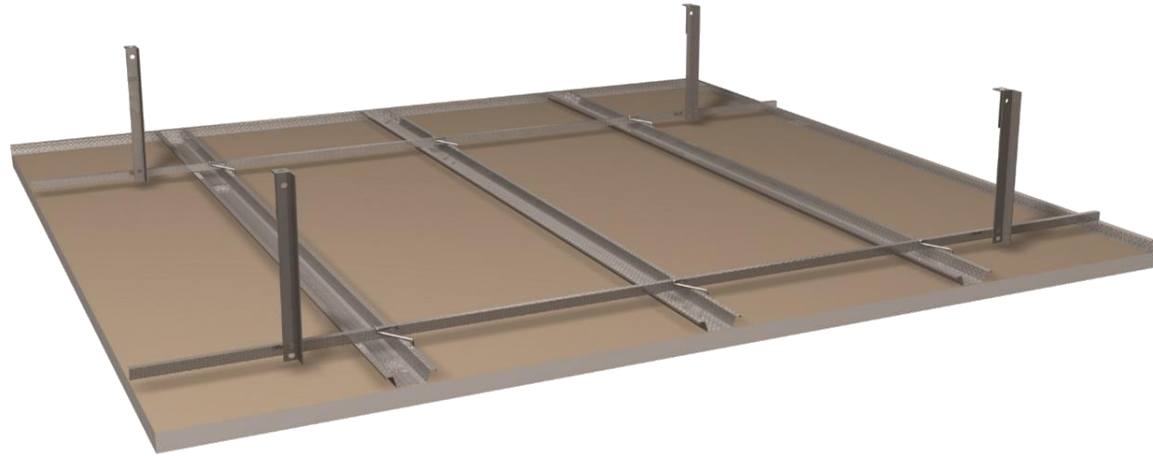


PRIME NUMBERS



It is good design practice to separate noisy from quiet areas when designing the interior layout

SAINT GOBAIN GYPROC – HIGH PERFORMANCE PARTITION AND CEILING





Building Type
Villas / Residential Buildings
Healthcare Facilities
Educational Facilities**
Commercial Buildings
Industrial
Public

Acoustic design of schools: performance standards

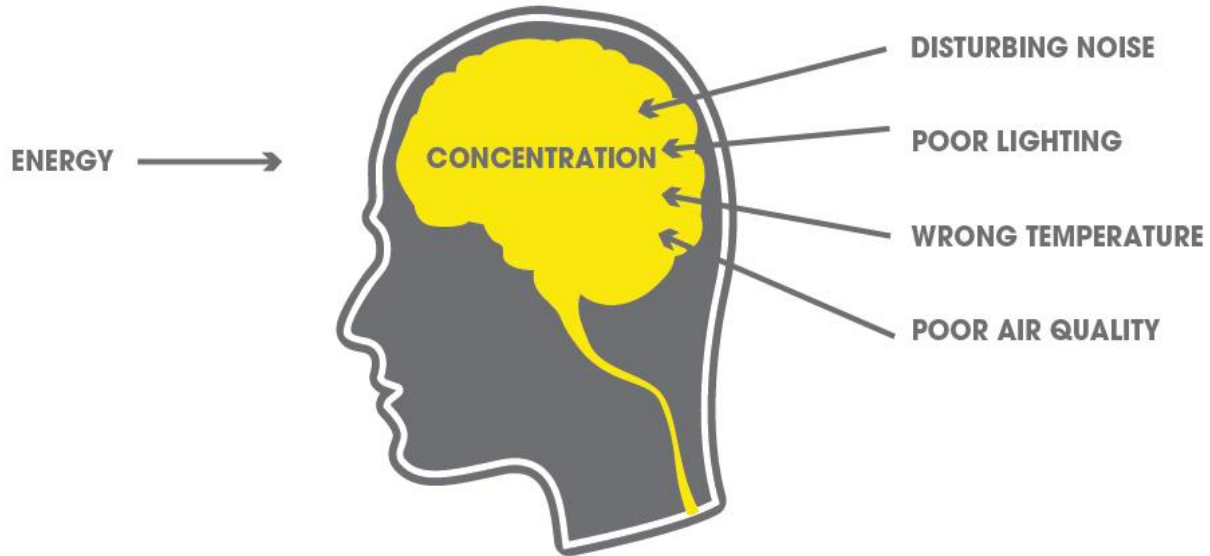
Building bulletin 93

February 2015

Introduction
Background (BSI BS 6841:2003 (UK))
Acoustic design
Acoustic design – A design Guide (UK)
Acoustic design for buildings – code of practice
Acoustic design for buildings – code of practice
Acoustic design for buildings – code of practice



Indoor internal environment affects concentration



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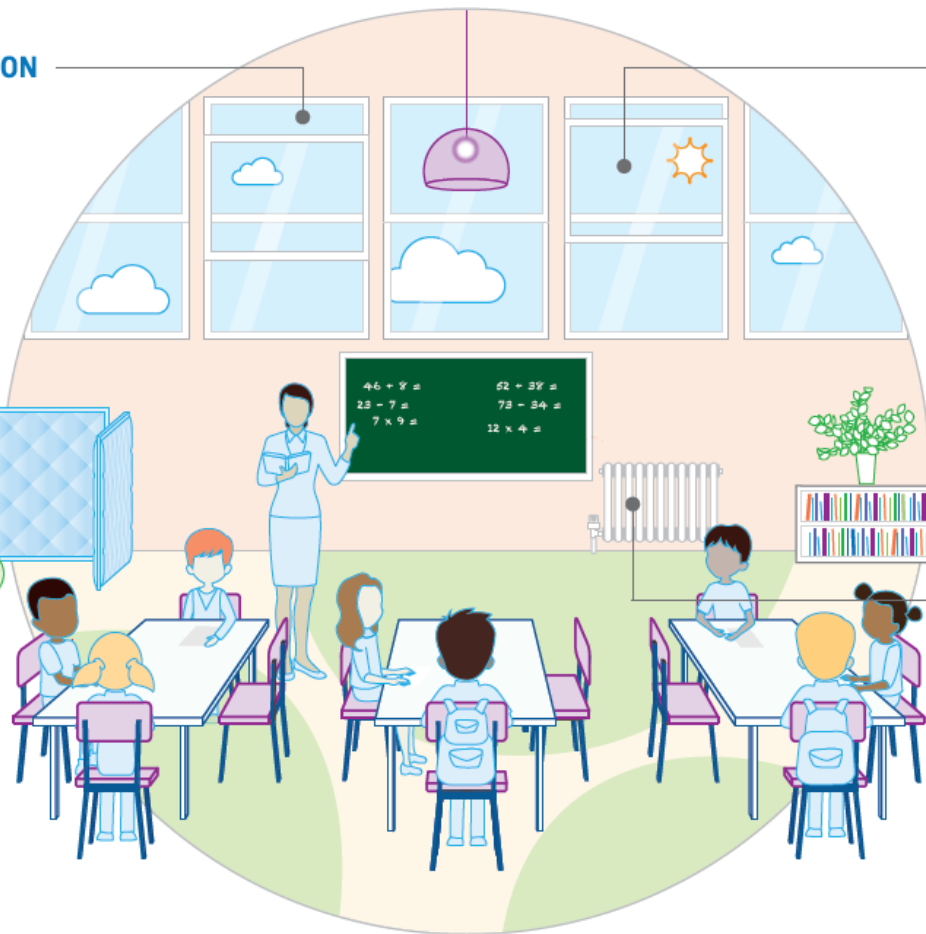


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Poor indoor air quality in schools can have a negative affect on children's health and academic performance.

SOLUTION:

Thoughtful school design and operation can improve indoor air quality and improve student health and performance. This can also most often be done without increasing greenhouse gas emissions.

What is indoor air quality?

Indoor air quality (IAQ) is defined by the concentrations of various pollutants, including:

- + Carbon dioxide (CO₂)
- + Volatile organic compounds (VOCs)
- + Moulds
- + Dusts
- + Airborne fungi

Specific concentrations of these pollutants, as well as ventilation rates, have been linked to sick building syndrome (SBS).

Indoor air quality affects children's health and comfort



Indoor exposure to VOCs

has been associated with SBS symptoms⁴
in schoolchildren⁵



Elevated CO₂ levels

have been linked to symptoms of
wheezing among children⁶



Low ventilation rates have been

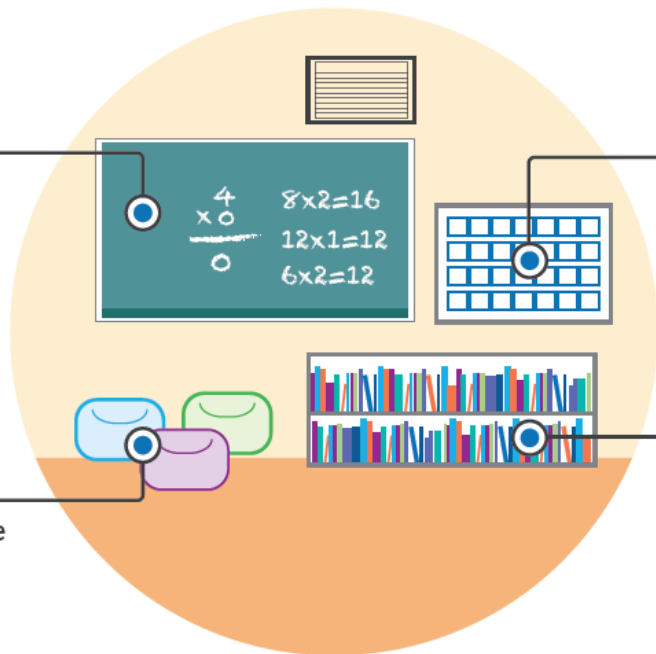
associated with increase incidences of SBS⁷
and nurse visits⁸

Indoor air quality affects children's performance at school

Examples of Positive Impact

↑ In a study of 100 US elementary classrooms, there was a **2.9% and 2.7% increase** in math and reading scores, respectively, for each litre per second per person increase in ventilation rates **9**

⚙️ **Higher ventilation rates** have been associated with faster and more accurate student responses for colour, picture memory and word recognition **10**



Examples of Negative Impact

↑ **A 1000 parts per million (ppm)** increase above ambient levels of CO₂ has been linked to a **10-20% increase in days** away from school **11**

🎓 **Every 100 ppm increase in** CO₂ was associated to roughly one-half day per year reduction in school attendance **12**

Indoor Air Quality – Better Air, Better future

90%

- Approximately the amount of time we spend indoors

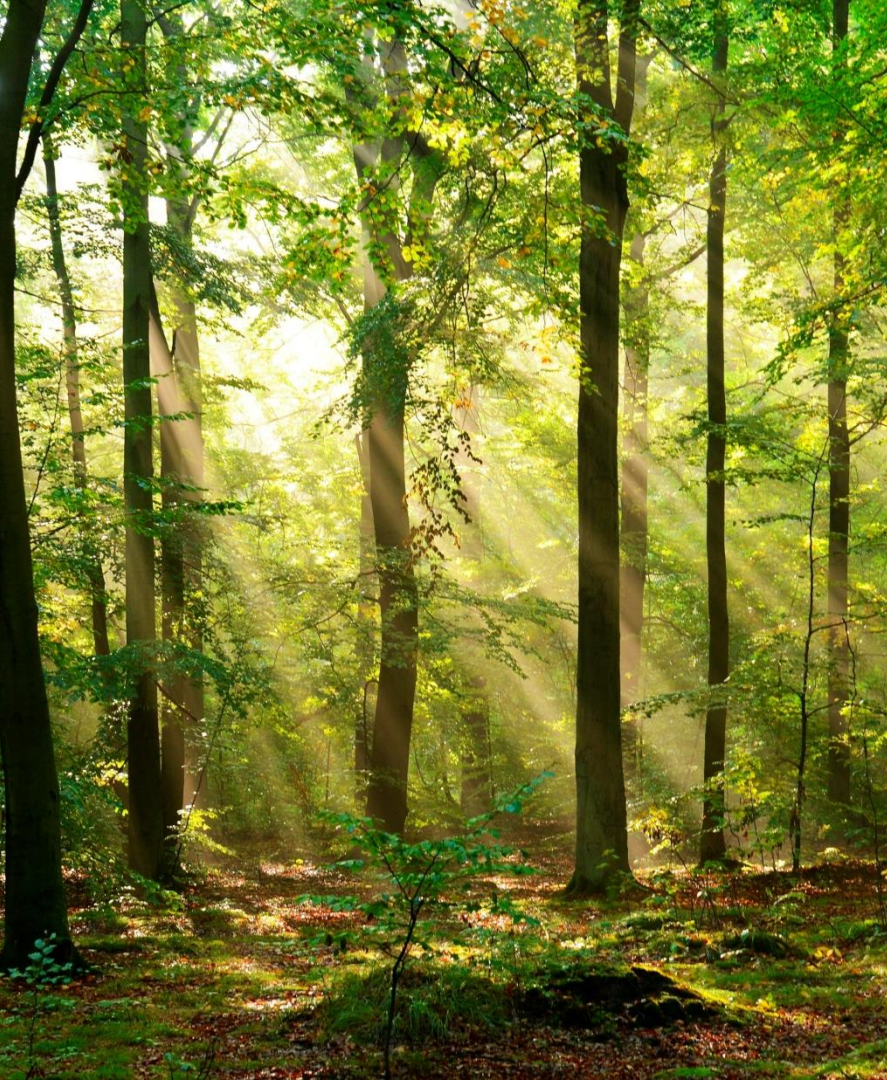
4%

- More than 4% of people suffer from asthma worldwide, with a higher prevalence in children (about 14%)

8%

- Is the increase in the speed performance of schoolwork done with the appropriate air supply

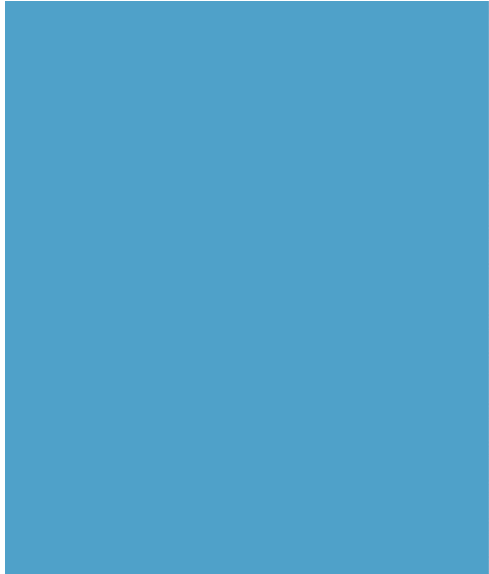




Use low emitting and certified building materials



ACTIV'AIR BOARD VIDEO

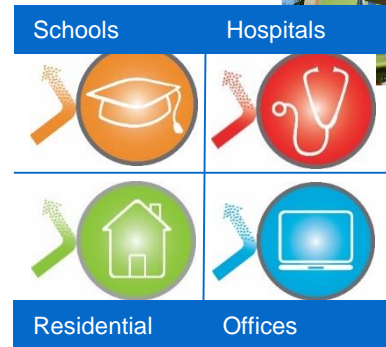


Active Air – Clears the air



- ❑ The first Gypsum board to clear the air!
- ❑ Uses an innovative technology to actively improve indoor air quality by taking formaldehyde out of the air
- ❑ Converts formaldehydes into safe, inert compounds that are captured in the board
- ❑ Cannot be released back in to the air
- ❑ Keeps working for 75 years

- Made with special additives in the core of the board
- Meets LEED requirements for buildings to have <26ppm VOC's
- Aids concentration and learning from cleaner air
- Available as standard with Gyptone perforated acoustic tiles & boards





THANK YOU FOR
YOUR ATTENTION

