Photo: Ole Jais

ECO

FOR SUSTAINABLE DESIGN

EDUCATION

LEARN FROM THE FOREST

STATE OF THE ART SCHOOL DESIGN

POLITICIANS FOCUS ON SOUND ENVIRONMENT

GROUND BREAKING ROOM ACOUSTIC RESEARCH

SUCCESSFUL INVESTMENT IN SCHOOL ACOUSTICS

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Ecophon's group of Concept Developers for Educational Premises are members of EDUnet and they can offer you an extensive range of knowledge and seminars which you can make contact and sign up for.

"Welcome to ECO – for sustainable design. The magazine that reports on research into the effect of sound on people and explains the significance of hearing and being heard in learning environments. It also provides up-to-date information from international acoustic seminars and tips on how to create a good sound environment. As well as many instructive examples of successful acoustic solutions in a variety of educational environments throughout Europe and beyond."

We are members of Ecophon's EDUnet: (top row from left) Guus Klamerek, Netherlands; Jonas Christensson, Sweden; Mai-Britt Beldam, Denmark; Colin Campbell, Globally responsible; Shane Cryer, UK; (bottom row from left) Pauli Pallaskorpi, Finland; Jiri Strnad, Czech Republic; Mikolaj Jarosz, Poland; Holger Brokmann, Germany.

Ecophon's EDUnet is an international team of specialists on learning environments, prepared to support people who plan, build or otherwise have responsibility in that field.

"We give you valuable advice, about how to best plan and improve the indoor environment in general and the sound environment in particular," say the team.

You are welcome to contact us with your questions. Contact details can be found on *ecophon.com* – you can find your nearest contact person for learning environments under the tab *"Acoustics"*. Ecophon EDUnet also offers an extensive range of seminars that you can sign up for.

ECO – For Sustainable Design is a magazine that focuses on the sustainable design of indoor environments. Our aim is to highlight the indoor environment, both from a functional and an aesthetic perspective, through an ongoing dialogue with our readers. Don't hesitate to contact any of our companies through the website, www.ecophon.com!

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Acoustic system from Ecophon: Ecophon Master™ Rigid E.

THE FOREST IS THE BEST **LEARNING SPACE**

Leave the classroom behind and go out into the forest. You'll get a lesson on what a good sound environment is.

Photo: Torbjörn Wrange

A FOREST IS THE BEST TEACHER if you want a lesson on how to distinguish a good sound environment from a bad one.

In schools, classrooms have flat, hard surfaces that cause sound reflection. This means that pupils sometimes have trouble hearing what the teacher is saying.

Outdoors, in a forest for example, there are no walls, ceilings or floors to create these disturbing reflections. This is where hearing is at its best.

For thousands of years, we have been developing our hearing in an outdoor environment full of natural sounds such as babbling brooks, the wind in the trees, birdsong and, of course, human voices too.

Sight and hearing most important

Of the five human senses, sight and hearing are the two most important in a teaching context.

To see clearly what the teacher is writing, a clean whiteboard, a good pen and good lighting are all required.

Photo: Olle Jais

Similarly, it is important that the teacher speaks clearly and loudly enough for the pupils to hear what is being said. Even the pupils at the back of the classroom.

But it is probably more likely that classrooms are equipped with good visual aids such as whiteboards than that they have been given the acoustic treatment necessary for everyone to be able to hear and be heard.

A Swedish researcher, Robert Ljung at the University of Gävle, demonstrates in his doctoral thesis that a poor sound environment in classrooms makes it more difficult for pupils to remember what they have heard. Pupils' short-term memory capacity is reduced due to the increased energy required trying to listen, making it harder to remember what is said.

Take some colleagues out into the forest to "test-talk" with each other.

Then go into the classroom, listen, and ask yourselves: "How similar is the sound environment to the outdoor one? Does the classroom help or hinder the pupils' and teachers' ability to perform?"

FIRST ECO-LABELLED PRESCHOOL HAS A FOCUS ON PEACE AND QUIET!

The children's and teachers' wellbeing is vital. A well planned visual atmosphere, good choices of lighting and colour and – not least – an excellent sound environment all combine to create peace and quiet, an important goal for the Brobækken preschool in Danish Odense.

"We have achieved our demands for peace and quiet, not least thanks to the good room acoustics."

Per Lykke, head of the Brobækken preschool.

Photos: Teddy Strandqvist

NOTHING HAS BEEN LEFT TO CHANCE with climate-smart construction. High levels of energy efficiency supporting a long-lasting, sustainable building. In addition, the healthiest materials possible, limiting any indoor emissions. All these factors are included in the Nordic Ecolabel requirements for the construction of school buildings.

Long waiting list

High ceilings, open spaces and lots of children usually ring warning bells when it comes to the acoustic environment. But not at the Brobækken preschool!

"We have achieved our 'peace and quiet' requirement thanks not least to the good room acoustics," says a very pleased Per Lykke, head of the Brobækken preschool. "This preschool is very popular among the staff, and there's a long waiting list of people wanting to work here."

He says that noise has never been a problem at the school, since it opened on 2nd May 2011. In addition to the good acoustics, an excellent visual balance has been created both in the individual rooms and in the open areas. Peace and quiet (and harmony) have certainly been achieved!

No more tiredness

Lisbeth and Trine, who work at the preschool, say that there is a special kind of light in the building and, together with the

Photos: Teddy Sinandbyrd

Trine Tovborg , the teacher who can just be seen in the left of the picture, says that the new environment is much better than at other places she has worked. Headaches and tiredness are a thing of the past. The sound pressure level here is only 57–65 dB(A) although there are sometimes about ten children who are eating, talking and playing at the same time.

Thanks to the sound environment, even the corridors are comfortable when used for lively activities.

furnishings and acoustics, these make it a very pleasant place to be. They don't suffer any more from headaches or tiredness, which they experienced at previous workplaces, and they say that the indoor climate is pleasant in every way.

No noise and visually attractive

When it's mealtime for the youngest children – those who make the most noise – the sound pressure levels measure just 57–65 decibels even though there are about ten children talking simultaneously.

The furnishings and the focus on acoustics have succeeded in creating an environment that is both free of noise as well as being visually attractive, meaning that the teachers can work more positively with the children's language development and social skills.

Photo: Teddy Strandqvist

Photo: Teddy Strandqvist

A well planned colour scheme and good lighting create harmony for the children and staff at the Brobækken preschool.

Flexibility has also been high up on the priority list. It is easy to divide off rooms for different purposes and create "rooms within rooms" by using sound absorbers on the sliding doors.

An inclusive children's environment

The preschool has places for children from every social group as well as for children with different specific needs or who require help with language.

The Swan has existed since 1989 and is the official Nordic Ecolabel. The environmental impact of goods and services is examined throughout their entire life cycle from raw material to waste, and there are demands regarding function and quality. www.svanen.se.

Fulfils Nordic Ecolabel requirements

The Brobækken preschool is the first to achieve the Nordic Ecolabel in Denmark. This means that it has to fulfil requirements in respect of building processes, materials and energy needs. The environment is taken into account throughout the entire process. No nanoparticles are accepted, PVC is forbidden, and the wood has to come from sustainable forestry, etc. In addition, the facade is built of recycled bricks, resulting in a saving of 15 tonnes of carbon dioxide.

The Nordic Ecolabel's concentration limit for chemical content is 0.01%, i.e. lower than the European REACH requirements for "candidate substances". In short, there are 51 obligatory requirements to be fulfilled in accordance with the region's official Nordic Ecolabel process.

Did you know...

...that reducing the sound level reduces the heart rate (a medically recognised stressor) and also reduces vocal stress and voice problems?

The goal: a toxin-free indoor environment

There is nowhere indoors we can totally avoid toxic substances but, in an ecolabelled preschool, the risks have at least been considerably reduced. And this preschool is also energy effective, giving a much lower carbon footprint.

In general, children are more sensitive to chemicals than adults. They are subjected to a greater exposure per kilo of body weight, they spend a lot of time on the floor, which is dusty, and they put things into their mouths.

Where possible, building products that have the Nordic Ecolabel should be used in order to fulfil the "points requirement". The sound absorbing materials for the ceiling and walls therefore have the Ecolabel too.

Architect: TKT Architects

Acoustic systems from Ecophon:
Ecophon Focus™ Ds
Ecophon Focus™ F
Ecophon Hygiene™ Performance
Ecophon Akusto™ Wall C

FACTORY NOISE IN SCHOOLS
POLISH RESEARCHERS RING WARNING BELL

NOISE IN SCHOOLS is disturbing and can be damaging to hearing. Awareness of this must be increased: for pupils and their parents, teachers and other staff, as well as everyone who in different ways has responsibility for school environments.

This was declared in a Polish report on research into the hearing status of primary school pupils in years 1 to 3. Almost one in three pupils (29%) had minor hearing disorders while 1.5% had more serious damage to their hearing.

The research was carried out in 2012 at seven primary schools in the Silesia region of southern Poland as part of a project called "Healthy child – healthy adult – healthy family", which has been run by Wojewódzka Stacja Sanitarno-Epidemiologiczna (WSSE - the regional state health and safety inspectorate).

Hearing in risk zone

Children's hearing risks being damaged at noise levels exceeding 75 decibels. The sound measurements conducted at the schools demonstrated levels greatly in excess of this, and were comparable to the noise in a factory or on a road with heavy traffic. In the sports hall, for instance, a level of 89 decibels was recorded. Heavy road traffic generates levels of around 90 decibels. Measurements were also made in corridors and classrooms.

These high noise levels create a number of problems. Noise in the corridors during breaks means that the pupils are not refreshed for their next lesson and then have difficulty in concentrating, with irritation and tiredness both increasing throughout the day. A noisy environment results in poor concentration, difficulty in hearing and being heard, and the teachers have to strain their voice – sometimes to breaking point.

The research into the pupils' hearing was conducted by the local department of the Polskie Towarzystwo Oświaty Zdrowotnej (PTOZ – Polish Association of Health Education) and Audio Service Siemens.

Halina Wiencek-Kipka, head teacher at Primary School No. 31 in Katowice, is convinced about the noise problems in the schools.

"A silent school? Yes, during school holidays," she says with a laugh, and confirms that a lot of pupils have problems with their hearing.

"In every class, we have two or three pupils with a suspected hearing impairment. In such cases we suggest parents visit an audiologist. Moreover, hearing problems occur among teachers as well."

Halina Wiencek-Kipka

The research report does not actually prove that the pupils' hearing problems have been caused by the noise in the schools. It only declares actual sound levels, medically determined hearing problems and the need for awareness of the negative impact of noise.

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 Polish schools.

Photo: Dziennik Zachodni

ALL PARTIES INCLUDED TO ACHIEVE GOOD TRANSFORMATIONAL LEARNING SPACES

The vocational training college from the 1970s in German Witzenhausen was going to be renovated. A project group comprising teachers, architect, consultants and the building authority was formed. All in an attempt to create a school with a good learning environment and a favourable work environment for the staff.

WHEN THE TEACHERS HEARD that the college was to be renovated they visited other schools to get an idea of how their workplace could be designed to the best advantage. They then explained their thoughts for the architect and the building authority. A project group was formed with all parties included and a description of their requests was drawn up before the architect started on the drawings.

Open-plan demand

The teachers wanted an open-plan solution where students and teachers could move around freely without the hindrance

Photo: HansGeorg Esch

Photo: HansGeorg Esch

Transformation of an old school.

Photo: Hans-Georg Esch

Glass walls break the sound waves between the surfaces but transparency is retained. An overall acoustic ceiling combined with wall absorbers for the best sound environment.

"We renovated a traditional school that had corridors with classrooms on each side," explains Jörg-Michael Brückner of plan B architekturbüro. "The school has now been completely remodelled and has an open floor plan, so it can be used in many different ways. Surfaces can be used in all directions and the layout is flexible and can be adapted and changed as required. This means that it's very important to have good room acoustics throughout the premises."

of closed doors. This placed extra high demands on the sound environment. All types of teaching have to function while people in other areas of the premises should not be disturbed. Overall sound-absorbing acoustic ceilings were installed to allow speech to be heard clearly in the teaching areas and to reduce noise levels. Sound-absorbing wall panels were also mounted, to limit sound propagation. Glass walls were added, separating some areas and thus breaking the sound waves while still retaining a good level of transparency.

See the Witzenhausen film at YouTube.

"The goal was to build a school providing the best conditions for the students' education as well as a good work environment for the teachers," explains Bernd Funk, head teacher. "We therefore put together a project group at an early stage in the process: teachers, architect, external consultants and the building authority. We are delighted with the result, as it's exactly as we had intended from the start."

Photo: Hans-Georg Esch

The corridors are a thing of the past and all space is put to good use.

Did you know...

... students behaviour was more positive and they managed to start the lessons earlier in comparison to the old rooms?

Architect: plan B Architekturbüro

Acoustic systems from Ecophon:
Ecophon Focus™ Ds
Ecophon Akusto™ Wall C

POLISH POLITICIANS FOCUS ON **SOUND ENVIRONMENT** – DESPITE FEWER STATE SUBSIDIES

Visit to Scandinavia was the starting point for new investment in schools in the Polish town of Police.

NO, IT WASN'T THE POLISH CHILDREN'S temperament that resulted in more noise in their schools than in the quieter Swedish ones. It was the poor room acoustics in the Polish schools that caused the pupils to be restless and noisy. This was apparent to the delegation of representatives from the town of Police in north-west Poland after visiting their Nordic neighbour.

In so far as the municipal budget allows, acoustic treatment is given successively to the schools in Police. The driving force behind the project is Witold Stefański, who worked for many years as a teacher before becoming head of Police's Education and Culture Department. During his teaching years he learned the hard way that noise is everywhere in schools, that it affects speech intelligibility and that it causes teachers voice problems as they have to raise their voices to be heard.

Inspirational study trip

During the study trip to Sweden, Witold Stefański realised that schools there were quieter on account of interior design that was different to that used in Poland. Swed-

ish children probably have just the same lively temperament as Polish children. The difference is that an effectively treated sound environment has a calming effect on people. We often say that "noise breeds noise".

Back home again after the visit, Stefański started to work resolutely on improving the room acoustics in Police's municipal schools. He invited acoustic experts to talk with school heads and teachers in order to identify which premises had the worst sound environment. Suggestions for technical solutions to the noise problems were then drawn up.

"Most important thing is awareness"

The next step was considerably tougher: convincing the town council that they had to start spending money on acoustic treatment. "The most important thing of all is to pay adequate attention to the problem," declares Stefański, who remembers the surprised reaction when he first brought up the question of bad room acoustics in schools.

"They thought that good acoustics were only needed in concert halls and theatres," he says, "but after the first acoustic treatment, with sound-absorbing ceilings, there was no doubt at all. The big entrance hall of Primary School No. 3 underwent a magical transformation after having been extremely noisy.

Head teachers have been encouraged to send in their own acoustical "to do" lists to the Education and Culture Department. The Department now has a waiting list of premises needing acoustic measures.

Not giving up – despite tougher budgets

Police is a town of 35,000 inhabitants, with nine primary schools for pupils up to the age of 12-13, and six lower secondaries for pupils between 13 and 16 years. The demographic trend in the town is the same as in the rest of Poland – over the past ten years, the number of pupils has decreased by 32 per cent. As the number of pupils determines the size of the state subsidy received by municipalities for running state schools, the budget in Police has been shrinking steadily.

But the realisation of the need for acoustic measures has caused the politicians to continue to earmark money even the budget is tight.

"Following the successful acoustic measures, no more arguments were required in order to gain the politicians' approval."

Over the past three years, premises in four municipal schools have been given acoustic treatment. These included a canteen, the entrance hall already mentioned, a corridor used as an extra gymnastics hall, and an assembly hall. The sports hall at Lower Secondary No. 2 was refurbished, where reverberation times of up to as much as 4 seconds were previously measured. Next in line for a better sound environment is Primary School No. 8, with a gigantic corridor of more than 100 metres where the sound level on average is above 85 decibels. Another school is the previously mentioned Primary School No. 3 where four classrooms are to be treated in order to reduce the reverberation time from the present level of about 2 seconds to an acceptable level.

Witold Stefański, head of the local Education and Culture Department.

Acoustic system from Ecophon: Ecophon Master™ A

GROUNDBREAKING CLASSROOM STUDY: **BETTER ACOUSTICS IMPROVES** THE LEARNING ENVIRONMENT FOR ALL

A large study at a comprehensive school in Essex (UK) showed that a moderate investment in improved classroom acoustics will result in a better learning environment. Both teachers and schoolchildren benefitted from acoustical refurbishment beyond the minimum standards.

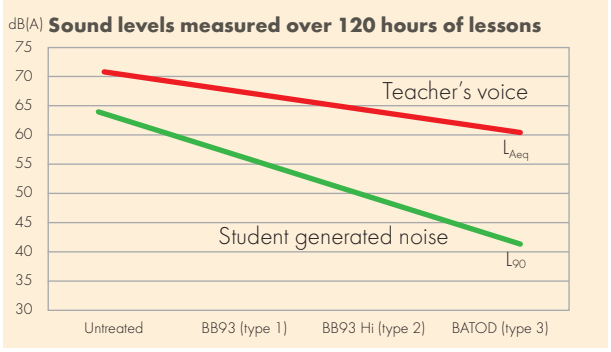
"THE FIRST TIME I ENTERED the classroom after the improvement something had changed, everything felt calmer and I automatically dropped my voice. I didn't want to go back to the old sound environment", says Simon Smith, learning environments manager at Sweyne Park School, about his first encounter with an acoustically treated classroom.

The refurbishment of three similar classrooms built in the 1950's and used by the maths department had a profound effect on the teaching environment at the Essex school. The improvement was part of a comprehensive experimental blind study of classroom acoustics involving more than 400 children as well as 13 teachers and communication support workers, and more than 120 hours of lessons were recorded.

Less stressful after acoustical treatment

Three classrooms were refurbished with sound absorbing wall panels and ceilings from Ecophon, specially developed for classroom environments. Each classroom was modified according to a different standard according to specific pupil recommendations. The type 1 classroom complied with a basic standard for a British secondary school. The type 2 classroom was compliant for use by deaf pupils and the type 3 classroom was refurbished to an even higher standard, recommended by the British Association of Teachers of the Deaf (BATOD). A fourth similar classroom was used as control and was left untreated throughout.

One of the main results of the study was that teachers found the acoustically treated classrooms better and a less stressful teaching environment. The pupils calmed down and their behaviour improved while listening more attentively, evidence of the so called "library effect" where a quieter room with less reverberance has a positive effect on speech behaviour. Reduced background noise triggered a reduction of the teachers' voice levels. In other words; the teachers could speak less loudly (or avoid raising their voices altogether) to make themselves heard, thus reducing vocal stress.



The more effective acoustic treatment, the quieter and calmer the sound environment. The difference is striking, especially between the untreated classroom and treated according to the standard of the teaching of the deaf (BATOD).

A group of school designers and education experts listening to Simon during a building study visit.

The better the treatment the better the results

Also, being able to hear the direction of voices made it easier for teachers.

"As a teacher I can hear who is disturbing the lesson and deal with that pupil, sometimes only by raising an eyebrow. In a non-treated classroom I have to raise my voice and ask the whole class to quieten down", says Simon Smith.

The study also showed that both staff and pupils preferred classrooms with a higher acoustic performance, with the more stringent type 3-classroom achieving the best results: compared to the untreated classroom, the student-generated sound levels decreased by around 30 percent and the teacher-generated by around 14 percent in the type 3-classroom.

Even though staff did not know what classrooms were acoustically treated, many of them made positive comments about the type 2 and 3 rooms. They reported improved behaviour in the type 2 and type 3 rooms, particularly when working with students known to present more challenging behaviour. One teacher stated that his pupils "became positively angelic".

Relatively moderate investment

Sweyne Park School has a large resource base for deaf students. As part of the research, hearing-impaired and hearing children were asked to repeat what their teacher was saying in various classroom settings. The gap between hearing impaired and hearing pupils' ability to hear the teacher narrowed considerably when the acoustics improved. In some cases deaf and hearing children performed equally. Better acoustics clearly helps level the playing field between deaf and hearing children.

The higher additional cost to modify a typical classroom of for instance 50 m² to higher specification from the minimum standard is a relatively moderate investment given the result.

"Ofsted* came to our school a few years ago and they said that we were good. We then did changes in the field of acoustics and last time Ofsted came they said that we were outstanding. I personally and my fellow teachers are convinced that good acoustics makes a fundamental difference for teaching and learning", says Simon Smith.

As a result of the findings all new primary and secondary schools commissioned by Essex County Council will be built to the type 2 standard as a new minimum, with care taken to deal with low frequency reverberation. The type 3 standard will be specified for classrooms used by deaf children.

"Even people with hearing loss can sit at the back of the classroom and hear what the teacher is saying."

Simon Smith

Experience this different sound responses on YouTube.

For more information:
- Essex study full report
- Essex study short summary

http://www.acousticbulletin.com

The Essex study report is now in OECD – Best practices for educational facilities investments.
Download the pdf from the link:
http://www.acousticbulletin.com/EN/2012/05/launch_of_essex_study_final_re.html

*The Office for Standards in Education, Children's Services and Skills

PRESCHOOL PÄRLAN TRANSFORMED **NOISE INTO GOOD TEACHING**

The Montessori preschool Pärlan in the Swedish village of Förslöv solved their noise problems by installing sound absorption that they also use in their teaching.

"We are also planning on ordering acoustic maps of the continents. This means that the acoustic aids blend naturally into our teaching environment."

Photo: Ole Jais

An overall acoustic ceiling combined with printed "pedagogic" sound absorbers in the ceiling angle did the trick.

Photo: Ole Jais

An example of how acoustic environment and teaching can go hand in hand: Wall absorbers as teaching aids.

"THERE HAS BEEN A COMPLETE transformation. I don't get tingling in my ears any more, and I feel a lot better," says Annika Malmander, teacher at Pärlan's Montessori preschool in Förslöv in southern Sweden. Annika has tinnitus and was very doubtful about returning to work at all after being off on sick leave last year. Most of the preschool, which is housed in a former library with a wooden ceiling, consists of one single open space measuring 250 m².

Everyone was negatively affected...

Right from the start, when Pärlan moved into the premises in the summer of 2010, the staff were disturbed by the poor acoustic environment and the children were also negatively affected:

"There was often a lot of irritation among the children, who covered their ears and yelled to outshout the noise," says Montessori teacher Åsa Månsson. "Mealtimes were the worst, with the noise of cutlery and plates resounding through the whole space so that the children couldn't relax and enjoy their food."

... and now everyone feels much better!

The change took place in the summer of 2012, when sound measurements were taken and then an overall acoustic ceiling and sound absorbing wall panels were installed during the winter. Then the sound waves stopped bouncing around the whole premises, Annika Malmander and her colleagues started feeling much better. And the 33 preschool children at Pärlan quietened down and the sound levels dropped.

"Neither we nor the children are as tired or stressed any more. There aren't so many conflicts and the children don't need to raise their voices to be heard. Lunches aren't filled with stress now – the children are calm and can relax and enjoy their meal," says Åsa Månsson.

Important for learning and language development

She also points out that the children can now concentrate better, without being distracted:

"The acoustic treatment has resulted in a much better environment that promotes learning, language development and the possibility for us to develop our goals. For the children who have concentration problems, a quieter environment is extra important," says Åsa Månsson.

Photo: Ole Jais

"The transformation is total. I don't have ringing in my ears now and I feel much better," says Annika Malmander, teacher at the Pärlan Montessori preschool. Her colleague, Åsa Månsson, agrees: "Neither we nor the children are as tired or stressed now."

Acoustic systems from Ecophon:
Ecophon Master™ A
Ecophon Akusto™ Super G
Ecophon Solo™ Baffle

Current research:

Noise levels in preschools are too high

An ongoing Swedish study indicates that noise is the most troublesome work environment challenge for preschool teachers. Hearing problems and tinnitus are more frequent among preschool staff than among Swedes in general. Preschool children are surrounded by noise levels that inhibit their language development. But, with the right measures, we can master the poor acoustic environment.

Photo: Johan Gunse

Researcher Fredrik Sjödin of Umeå University in Sweden declares that teachers suffer from high noise levels in preschools.

Children's voices and the noise from their activities are the single most troublesome work environment factor for preschool staff. Tinnitus is 15–20 per cent more common among preschool staff than among the general population. This is claimed in a doctoral thesis by Fredrik Sjödin at Umeå University in the north of Sweden, (Buller i förskolan – Hälsa och åtgärder, 2012 – Noise in preschools – Health and preventive measures, 2012).

Among other things, Sjödin has measured how much of the stress hormone cortisol preschool teachers secrete during their work. Measurements and estimates demonstrate a pronounced level of stress and, in many cases, burnout. Sjödin's studies, performed at 17 preschools in Umeå, also indicate that auditory fatigue at the end of the working day is common, as are problems with sleep.

The number of reports of work-related injuries at preschool has increased in recent years. A study of preschool children, conducted by Kerstin Persson Waye at the Institution of Occupational and Environmental Medicine at the University of Gothenburg in Sweden, shows that preschool children are subjected to noise levels that are so high as to be hazardous for children as well as adults.

STATE OF THE ART DESIGN FOR SCHOOL IN HOLLAND

Alfa College Groningen is an excellent example of modern Dutch school architecture. A spectacular shape and facade and a meticulously planned indoor environment were the result of the project. Combining the sound environment with thermal joints was an interesting challenge.

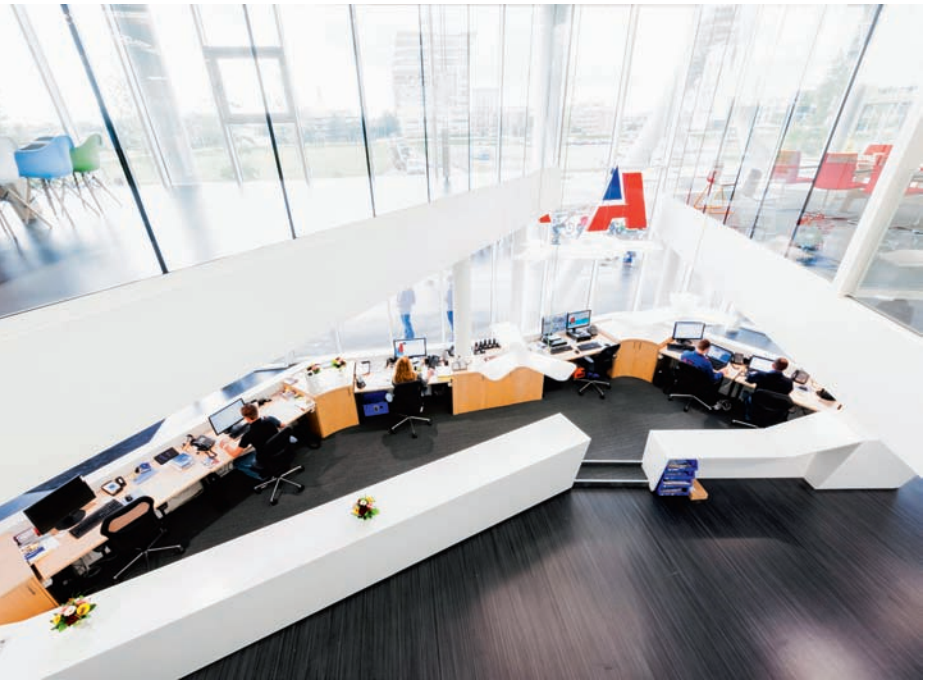


Photo: Ruud Hoornstra

Photo: Ruud Hoornstra

A spectacular, exciting exterior, don't you think?

Photo: Ruud Hoornstra

The intention is for the students themselves to bring colour into the predominantly white environment. Local designers have created foil visuals for the glass walls and luminaires in the areas where the students have their workspace.

Photo: Ruud Hoornstra

An ideal solution for promoting the sound environment while still allowing the concrete mass to regulate the classroom temperature is free-hanging sound absorbers.

IN FRONT OF ALFA COLLEGE GRONINGEN, is the Euroborg Stadium where FC Groningen play their matches in the Dutch premier league. The stadium was designed by the famous Dutch architect Wiel Arets, who also created the master plan for the whole area, with the college as a key element.

Best quality

AAS Architecten of Groningen designed a unique building. Quality requirements were very stringent. The exterior is clad with ceramic tiles that were developed and produced in Japan and this is the largest project in the world using these tiles. The windows were designed to minimize the sun causing overheating indoors, while still making the most of the daylight.

Room acoustics for exposed concrete structures

The architects focused on all the important indoor environment factors: climate, acoustics and lighting. TABS (Thermally Activated Building Systems) are used for cooling and heating the classrooms. It was therefore not possible to install wall-to-wall, sound-absorbing acoustic ceilings in the classrooms, as these would prevent heat transfer. Making best use of the ceiling, which is the most effective surface for sound absorption, was therefore a challenge.

The architect, Aron van Delft, had past experience of similar projects and felt inspired by the task. By using free-hanging sound absorbers in the ceiling, there would be no loss of radiation heat transfer. In addition, an aesthetically interesting ceiling was created, with layers of "floes" that slide over each other.

Wall-to-wall acoustic ceilings were installed in spaces that did not have TABS. All for the sake of achieving the best possible sound environment.

More about Alfa College Groningen

The college has several programmes: administration, law, economics, business and ICT (information and communication technology) as well as creative courses such as game architecture and design, media and fashion. The college has about 1400 students and 150 employees.

Photo: Ruud Hoornstra

Photo: Ruud Hoornstra

"The acoustics are excellent as I hear from a lot of people," says Facility Manager Jaap Hoeksema (on the left) who is very pleased with the cooperation with AAS Architecten and the architect Aron van Delft.

Photo: Ruud Hoornstra

An overall acoustic ceiling was installed in areas without thermal joints.

Architect: AAS Architecten

Acoustic systems from Ecophon:
Ecophon Solo™
Ecophon Gedina™ A & E
Ecophon Hygiene™

ROWDY SCHOOL INVESTED SUCCESSFULLY **IN ACOUSTIC ENVIRONMENT**

When the Kubikskolan private school in Helsingborg, Sweden, took over a municipal school, Fredriksdalsskolan, there was no lack of challenges. One of them was the disastrous acoustic environment in the science labs.

"A DROPPED PEN echoed throughout the whole lab. And if a pupil spoke to another at the same table, everyone could hear clearly. Even whispering was heard. It was like a ghastly mess of sound," says science teacher Jesper Strand.

Since experiments are done in groups and require teamwork, the sound level rose as everyone tried to outshout the noise. The pupils also had difficulty in concentrating on their assignments.

Jesper Strand explains that he had to exaggerate and pretend to be angry to get the noise level down.

"It means poor interaction between teacher and pupil if I have to shout instead of teach."

He has previously had problems with stress-related tinnitus. The symptoms were aggravated in the science lab.

Head teacher Lars Dalesjö, who is one of the owners of Kubikskolan, says that it was vital for something to be done about the situation.

"Our teaching is based on being structured and creating a peaceful environment, and this was certainly a major challenge."

Correcting the room acoustics in one of the science labs was the first step. This was done during the summer. When the pupils came back from vacation they found acoustic ceilings and wall absorbers that completely transformed the previously noisy sound environment.

"Silent"

"It was silent in the lab. The pupils now come in quietly and sit down to wait until the lesson starts," says Jesper Strand. "The sound absorption has a calming effect on the pupils, who are much less rowdy, and my tinnitus is not getting any worse."

Jesper Strand goes on to say that the pupils now hear what he says without him having to raise his voice, and the quality of their experiments has also improved.

Satisfied with the new sound environment, the school continued with acoustic treatment of the other science lab.

"We are a traditionally orderly school, with teacher-led lessons and with homework. We try to help the children with their learning. An effective acoustic environment is fundamental for success," says Lars Dalesjö.

There was a large proportion of immigrant children in Fredriksdalsskolan's classes. Kubikskolan works consciously on

"It used to be cold, hard and clattery. I avoided the science lab as much as I could. Now it's like going into a cosy candlelit room. It feels almost spiritual. It's much pleasanter to teach and I don't need to make an effort for the children to hear me."
Teacher Louise

Photo: Ole Jpis

Head teacher Lars Dalesjö and teachers Jesper Strand and Louise Vernet are very pleased with the new sound environment.

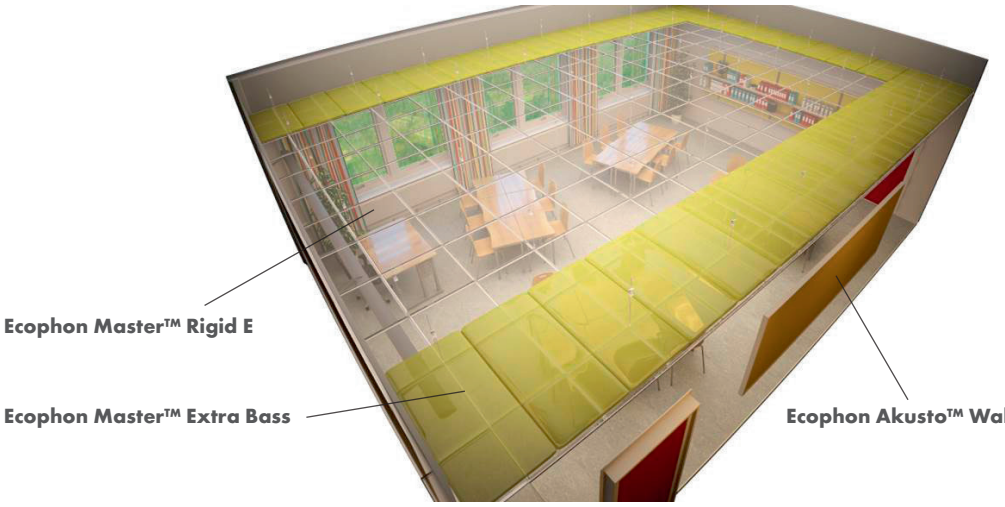
"The lessons in the science lab are better. All the echoing was really tiring before. It's easier to hear what other people say now. It feels like a completely new room."
Mariamma, Year 8

Photo: Ole Jais

Ecophon Master™ Extra Bass has been installed above the acoustic ceiling, in order to reduce low-frequency sound reflections. Ecophon Akusto™ Wall C in the background. The sound behaves similar to the forest with no disturbing sound reflections which positively affects the speech intelligibility.

integration by giving children from deprived environments the same opportunities as children from more affluent ones. According to Lars Dalesjö, positive changes are apparent since taking over Fredriksdalsskolan in the autumn term of 2010.

"Pupils who used to cause trouble attend the lessons now. But they've got years of neglected schooling to catch up on. For the children to be able to concentrate, a good acoustic environment is a must."



An example of how to create the optimal sound environment: A wall-to-wall acoustic ceiling with thick low-frequency sound absorbers above it, in combination with wall absorbers.

More about Kubikskolan

Kubikskolan now has 380 pupils from preschool through to year 9. The school includes a mathematical, scientific profile. Pupils who have chosen this profile get more teaching hours of mathematics and science subjects than a regular class. Half of the pupils applied to the school's special profile while the other half come from the school's own catchment area. About one in three pupils has home language instruction. The school was founded in 2000.

Acoustic systems from Ecophon:
Ecophon Master™ Rigid E
Ecophon Master™ Extra Bass
Ecophon Akusto™ Wall C

Photo: Ector Hoogstad Architecten

Port City Waalhaven in Rotterdam (Europe's largest port) will be undergoing major redevelopment in the coming decades. In the southern part of the area (at the bottom of the photo) there are office buildings and, to the far left, the Shipping and Transport College can be seen during the building process.

INNOVATION AWARD FOR COLLEGE AT HEART OF EUROPE'S LARGEST PORT

A college in Rotterdam was nominated for the Dutch Scholenbouwprijs (an award for school buildings). Eight schools where selected from over 200 and the Shipping and Transport College won the "Innovation Award". Proof yet again that function and design go hand in hand. Room acoustics had the highest priority in the project.

Photo: Marcel van der Burg

An open, transparent facade welcomes visitors to the Shipping and Transport College (STC).

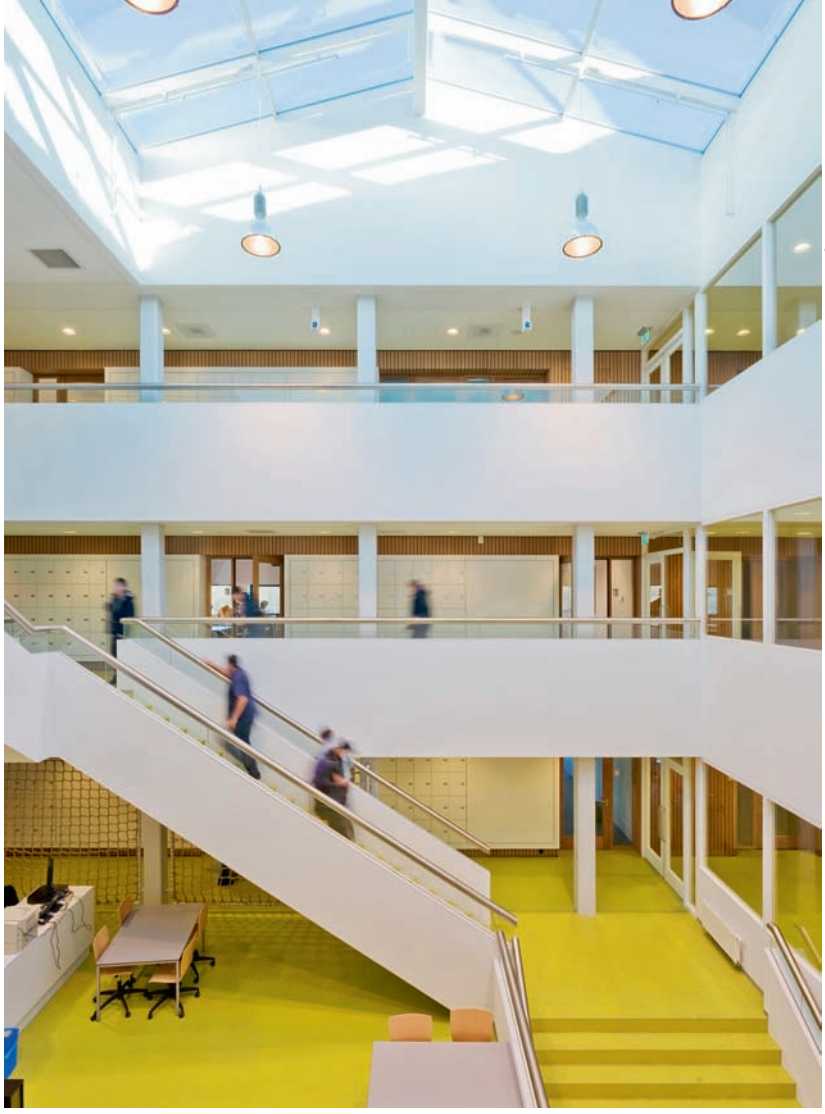


Photo: Marcel van der Burg

The building is flexible, with a layout that can easily be adapted for different uses in the future. The structure is visible throughout the building, with its steel junctions, trusses and stabilizing elements. Modern, robust, functional materials create a low-maintenance building.

ONE AREA OF THE PORT of Rotterdam, the largest in Europe, is undergoing major redevelopment as a location for business offices and educational facilities. Modern architecture is giving much of this Waalhaven area a huge boost. It would be hard to find a better place for the Shipping and Transport College (STC). Students are taught here in the areas of shipping, port operations, logistics and transport.

Bold, functional design

The building, with its bold design, matches the atmosphere of shipboard and dockside environments.

The ground floor breathes dockside activity, with a workshop hall featuring containers, an HGV and a crane. A restaurant and sports hall are also located on this floor. The other floors accommodate the educational facilities and conference rooms, with the top floor offering a fantastic view over the port. The design incorporates modern, rugged, functional materials to create a low-maintenance building with flexibility for change.

The college has been nominated for the Dutch Scholenbouwprijs and is on a shortlist of eight schools out of 162 participants.

"Acoustics more important than aesthetics"

With the layout being open-plan, there were high demands placed on the sound environment and on sound absorption. Architect Robert Alewijnse of DP6 wanted the acoustic ceiling to be aesthetically pleasing as well as functional. He wanted as smooth a ceiling as possible and he succeeded in finding an excellent solution.

The Shipping and Transport College building has a clear, transparent, open layout that has been adapted for educational activities. The acoustician as well as Robert Alewijnse agreed that an open-plan design meant that the importance of acoustics could not be underestimated, resulting in the need for an effective, sound-absorbent acoustic ceiling.

"Good acoustics are extremely important for people's wellbeing," declares Robert Alewijnse of DP6. "Particularly in teaching premises where large numbers gather in order to learn, listen and concentrate."

His theory is that people can probably get used to an "ugly" interior after a while, but they will always suffer from poor acoustics.

"I actually prefer a smooth, plaster ceiling that doesn't attract attention," says Robert Alweijnse of DP6. "The acoustic ceiling we chose gives that impression. It has a smooth appearance, with the bevelled edges forming a very discreet joint between the large ceiling panels. It's also possible to integrate luminaires into the ceiling."

Architect: DP6

Acoustic systems from Ecophon:
Ecophon Super™ G Plus
Ecophon Focus™ Ds
Ecophon Hygiene™ Protec

THE ART OF TRANSFORMING EDUCATION

Ten years ago, two classrooms at Rødkilde School in Copenhagen were renovated into tiptop condition. Much was improved, but the acoustic environment was still disappointing.

However, sound absorbers on the ceilings and walls, supplemented with sound absorbing screens, have now been added and solve the problem. Anything is possible, however it is more costly when investments may be required in retrospect.

It's always best to plan properly and consider the sound environment from the start.

Photo: Teddy Stenström

As requested by the teachers, the wall absorbers in the two rooms have cheerful, colourful designs. The surfaces of the wall absorbers and the sound absorbing screens are hardwearing and can also be used as noticeboards.

"The sound absorption is so effective that we can have several small groups in the area at the same time without the pupils disturbing each other."

Jan Vang Rasmussen, teacher and safety representative at Rødkilde School.

Photo: Teddy Strandqvist

In another, larger classroom, a fully covering acoustic ceiling was installed, together with wall absorbers in order to optimise speech clarity and reduce the reverberation time to 0.41 seconds including control of the unwanted booming low frequencies. The acoustic conditions in these premises are also suitable for pupils with hearing impairments.

"WHEN WE RENOVATED the classrooms, a lot of focus was placed on the ideal conditions for the purpose: the teaching of design and technology," says Jan Vang Rasmussen, teacher and safety representative at Rødkilde School in Copenhagen. "This resulted in large windows giving lots of light and a new, effective ventilation system that's so good that the air in the rooms is cleaner than the outdoor air. But room acoustics were not something we had discussed..."

Halved reverberation time did the trick!

It turned out that noise was a major problem in both of the newly renovated premises. Practical subjects generate noise and this disturbance had a very negative effect on the teaching. Not least in the larger room, which is used for visual arts. The only solution was to move the teaching of design and technology to other premises.

"Instead, we decided to use these two rooms for special teaching and for foreign languages," continues Jan Vang Rasmussen. "With the help of a local consultant, we found out what was required if the premises were to be used for teaching. The acoustic measurements turned out to be very deficient – a long reverberation time of over 0.8 seconds!"

In August 2012, when the autumn term started, the sound absorbers had been installed. The premises are now ideal for teaching and learning which that requires particular concentration – special teaching and the teaching of pupils whose mother tongue is not Danish.

"It's no surprise that everyone's happy now," says Jan Vang Rasmussen. "The reverberation time has been halved and is now just under 0.4 seconds in both rooms. These are the best conditions for pupils who have a different mother tongue and who need to learn Danish, and for pupils with learning difficulties. Short reverberation times is one of the factors to measure the quality of the sound environment, and most often referred to in acoustic standards."

Fewer conflicts and more enjoyment

Jan Vang claims that this does not only benefit communication. Sound absorbers also reduce conflicts. Noise can otherwise create clashes among the pupils if they misunderstand what the teachers are saying. The wall absorbers are colourfully decorated too, creating a pleasant atmosphere that reduces the risk of them being spoiled by graffiti and other damage.

"In an environment like this, no-one can be angry," says Jan Vang Rasmussen.

Rødkilde School has learned a lot. The acoustic treatment is being extended successively to the whole school and will be included in future budgets.

Photo: Teddy Strandqvist

Free-hanging sound absorbers were installed in the ceiling – a smart solution that improves the acoustic environment significantly. The sound absorbing screens make the premises flexible and the rooms can be divided up as required.

Acoustic systems from Ecophon:
Ecophon Akusto™ Wall C
Ecophon Solo™
Ecophon Master™ Rigid Dp
Ecophon Extra Bass™

SMART SOLUTIONS THAT WORK WONDERS

Relatively simple measures transformed an "acoustically hopeless" room into an effective learning environment in Abbotts College in Pretoria East, South Africa.

ANCY ATTICULLA, A TEACHER who was new to the school, felt that the classroom she taught in was extremely noisy. She was keen for changes to be made and, when she explained this to the principal, Andries van Renssen, he was very enthusiastic. Improving the acoustics became a priority for the school.

The classroom, used for science lessons, had hard walls and ceilings, resulting in a noisy environment which was difficult to teach effectively in.

During a period of four months ending in 2013, the classroom underwent an acoustic transformation. An acoustic ceiling was installed, as well as wall absorbers. The difference was dramatic.

Reverberation time down to one-third!

The acoustic measurements showed a reduction of the reverberation time from 1.34 to 0.4 seconds – improving the learning environment to being the best possible! The changes also resulted in better speech intelligibility, and lower sound levels, giving a more disciplined, calmer behaviour.

All-round praise

A questionnaire was conducted before and after the acoustic treatment. Staff as well as students were delighted with the changes.

The principal, Andries van Renssen at Abbotts College, explains: "The class used to sound 'hollow'. There was an obvious echo, which resulted in students not being able to hear the teachers properly, especially when they were working in groups or when there were other noises in the class.

"The change is dramatic" continues Andries. "The atmosphere in the class is quieter – almost more 'academic'. The teacher can be heard clearly. When students have group discussions, there isn't a noisy atmosphere; they can hear one another in each group."

He elaborates: "Class discipline isn't just about a strict teacher or someone who can handle a noisy class. Without students realising it, a classroom's sound quality has an impact on the class atmosphere and on the ability to concentrate and participate meaningfully in lessons. I always try to manage the school in such a way that there is as little distracting noise as possible."

Conversations with improved speech clarity

Ancy Atticulla, the teacher who originally pointed out the shortcomings, is delighted: "The acoustic improvements in the science lab have hugely improved the quality of the sound in the room. The spoken word now 'carries' well in the room. There's no more echoing and the students can hear me very well without me shouting. Even a soft-spoken person can be heard well. The students are also becoming self-disciplined. Their conversations can be heard so they tend to behave well."

Facts Abbotts College

Abbotts College has campuses in Claremont and Century Gate in Cape Town, Northcliff and Johannesburg South, and Pretoria East, South Africa. An additional campus will open shortly in Centurion. The college understands that the final phase of schooling is critical and that it shapes and determines a young person's future. Abbotts College's goal is to achieve optimal results and to provide every student with the best opportunity to attain these.

Photo: Thys Dullaart

For good levels of speech clarity (D50) we recommend a level above 80%. In this classroom speech intelligibility has increased from 43% to 85%, ie to a level that is perfectly acceptable.

Improving classroom acoustics – before and after with the principle Andries van Renssen at YouTube.

Watch and use these "unique" educational environment resources!

THE SOUND EDUCATION [1] seminars have created a legacy of online resources including; Filmed presentations on four YouTube playlists per event in local languages, research study downloads (see Essex Study page 12 of ths issue) and a Study App [2] free to download launched at the events.

Moreover, the latest TED Talks [3] by Julian Treasure has taken the acoustic message to a higher level and highlighted the importance of the Sound Education events in raising awareness about sound and educational environments.

Sound Education events linked and highlighted the relationship between sound and the teaching and learning environment. They were integrated via the platform "Sound Education" – brought to you by Ecophon, which started a call for action for the future of optimal learning environments. The audience participating in the Sound Education events came from key education groups consisting of local authorities, teachers, politicians, architects, acousticians, occupational health staff, teachers' unions, local presidents of acoustical societies etc.

Some of the subjects covered during the events are listed below;

- Voice aspects
- Noise and memory
- Classroom acoustics and inclusion
- The architects' view regarding sound and design
- Teachers' and school leaders' perspectives
- Pupils' acoustic challenges

[1]

Free Study App!

[2]

iTunes version

Android version

We recommend downloading the App via Wifi.

[3]

TED Talks with Julian Treasure: "Way architects need to design with there ears".

600 000 hours in the classroom

LET US SAY THAT A CLASSROOM has 25 students and a teacher. The room may be used six hours per day, five days per week for 40 weeks, that is, 1200 hours per year. A school may be renovated or refurbished after 20 years and the room has then been used 24 000 hours by an average of just over 25 students and a teacher. Overall, we may be talking about 600 000 user hours or more during the life of the classroom.

Studies have shown time after time that if good sound absorption is lacking, learning is impaired and the risk of occupational diseases like stress, impaired hearing and tinnitus increases. By choosing the right amount of high sound absorbing materials and its placement*, makes life healthier, pleasanter and more effective and reduces social costs as more students meet learning goals and staff sickness absence falls.

Photo: Shutterstock

* See example on page 19.

FINNISH INSTITUTE OF OCCUPATIONAL HEALTH ON WALL ABSORBERS:
ECO-FRIENDLY NOTICE BOARDS

Notice boards are among the most important hubs at a workplace, and there is no problem about attaching notices directly onto wall absorbers. But how much fibre emission from these acoustic panels do pinpricks actually cause? Is it environmentally safe to use wall absorbers as notice boards?

Tested and approved wall absorbers as notice boards.

TO ANSWER THIS, Ecophon assigned the Finnish Institute of Occupational Health the task of measuring the emissions. The result was reassuring, to say the least.

Of course, it is not only in offices that wall absorbers are used as notice boards. The same thing applies at pre-schools and schools, where the children's drawings and the like are put up on the walls. Here the wall absorbers are used to reduce the reverberation time, reduce the noise level and improve speech intelligibility. When pins are used on the panel, the glass wool at the sound absorber's core emits a tiny amount of fibre.

A total emission of up till 0.2 fibres per square centimetre during a two-week period is permitted if indoor air is to be deemed to be of good quality. The VTT Technical Research Centre of Finland states this in their guidelines for public buildings.

Tested 12,000 pinpricks

The Occupational Health Institute used 25 pins to test the wall panel. Emitted fibres were collected with a special tape from a steel plate placed below the panel. Samples were taken after pins had been stuck in and taken out 0, 400, 2,800 and 12,000 times.

After two weeks, the test demonstrated that Ecophon's wall absorber had emitted 0.14 fibres per square centimetre. A result that is significantly below the guideline value recommended by VTT.

Based on this result, the Finnish Institute of Occupational Health concluded that Ecophon's wall panel products are safe to use as notice boards. Ecophon Akusto™ Wall C has also been granted the allergy label of the Finnish Allergy and Asthma Federation, and is included in the Finnish emission class M1 (the strictest class) for building materials.

The Occupational Health Institute also declared that the panels' appearance did not deteriorate as a result of the stringent test.

Testing of wall absorbers at the Finnish Institute of Occupational Health, Helsinki.

Acoustic systems from Ecophon:
Ecophon Akusto™ Wall C

A WORK OF **ACOUSTIC ART** IN SOUTH AFRICA

The acoustics in the entrance to the Aula on the University of Pretoria's campus in South Africa needed improvement. The solution was a magnificent symbolic tree with leaves made of sound absorbent panels.

Photo: ARC Architects

When it's dark, images can be projected onto the sound absorbers. Cool, isn't it?

THE AULA IS THE CULTURAL HUB of the University of Pretoria's campus, one of South Africa's leading institutes of higher education. The university is proud to be able to achieve the country's best research results, and it offers more than 1,800 academic programmes.

The imposing tree reaches high up towards the roof above the entrance to the Aula. The trunk is a concrete column and the branches are decorated with free-hanging sound absorbers which are in different colours. An excellent example of how aesthetics and room acoustics can be combined.

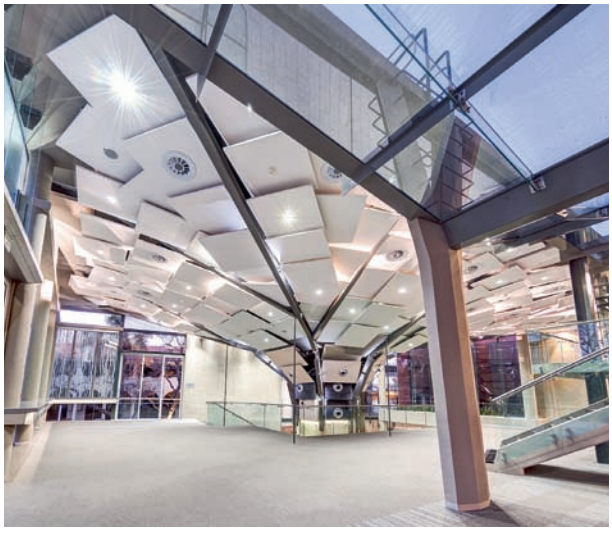


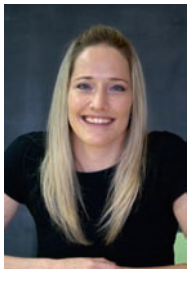
Photo: ARC Architects

A clever hanging system makes installation easy and spotlights or other installations can be added to the panels. There are endless possibilities for creating different solutions.

Effective sound absorption

Most importantly – the sound absorbers must have the ability to absorb the sound within a broad spectrum of frequencies. Around 200 absorbers combine to represent the leaves of the tree.

"Ecophon Solo is the ideal product for focal areas where there is a requirement for light, floating elements with an added acoustic attribute. I wish I had come it across earlier in my career."



Madi van Wyk, Director ARC Architects.

Architect: ARC Achitects

Acoustic systems from Ecophon: Ecophon Solo™

FREE SUBSCRIPTION!

This magazine focuses on the sustainable design of our indoor environment. Our aim is to highlight the indoor environment, in both a practical and an aesthetic perspective, and to make people's effectiveness and wellbeing our focus area.

You can subscribe free of charge to ECO – For sustainable design by going to www.ecophon.com/eco and filling in your details and also specifying which concept areas interest you: office spaces, educational premises, healthcare premises or industrial premises with hygiene requirements. You can cancel your subscription at any time.

www.ecophon.com/eco

Photo: Teddy Strandqvist

A quick summary about how the sound environment affects teachers and students.

Good classroom acoustics – teachers:
- Reduces vocal stress e.g. sore throat, loss of voice etc.
- Assists teachers deliver flexible pedagogic approaches e.g. group work
- Allows the lesson to start in a positive atmosphere

Poor classroom acoustics – teachers:
- Increases vocal stress and voice problems
- Increases the heart rate – a medically recognized stressor
- Increases class interruptions e.g. repeating yourself

Good classroom acoustics – students:
- Improves focus, concentration and memory
- Increases motivation and student engagement
- Improves classroom behaviour

Poor classroom acoustics – students:
- Makes it harder to hear what is said
- Makes students talk louder
- Reduces concentration

Don´t forget the free Study App!

iTunes version **Android version**

We recommend downloading the App via Wifi.

Educational Environments LinkedIn

JOIN THE "EDUCATIONAL ENVIRONMENTS"* group on LinkedIn and take part in or follow the debate and discussion. Request membership directly if you are a LinkedIn member or create an account when you follow the link.

*a subgroup of the Acoustic Bulletin.