TROX

life magazine no. 22

Ventilation!

School + ventilation.

Intelligent ventilation technology needs to catch on.

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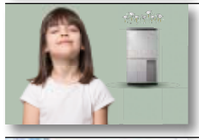

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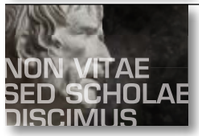

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Intelligent ventilation technology needs to catch on.

What is the foundation for a good (school) education? Productive and sustainable learning, of course. Parameters such as the architectural design of the learning environment and, in particular, the indoor climate and ventilation also play a crucial role.

And yet, students and teachers in many schools can only dream of a classroom that meets minimum air quality standards. While in other countries, particularly in Scandinavia, good air quality has already been established in the majority of schools for years now thanks to regulations and funding for mechanical ventilation systems, in Germany, there has been hardly any progress – even though there are relevant minimum requirements for mechanical ventilation systems in schools, including an outdoor air flow rate of more than 25 m^3/h per person in the room, a sound power level of less than 43 dB(A), comfortable and continuous indoor air flow or the use of heat recovery and a demand-based single room control system. Reasonable parameters, sustainable and highly beneficial – with manageable investments: high-quality air via decentralised ventilation systems costs just 25 cents per student per day!

We talked about this with Professor Geo Clausen from Denmark, one of the most renowned researchers in the field of school ventilation. He estimates that a good environment for learning and well-being increases Denmark's GDP by around €173 million – thanks to increased productivity, fewer absences and fewer students needing to repeat years at school. Other reputable researchers have also come to definitive conclusions: mechanical ventilation provides better learning conditions and improves well-being. Studies clearly show that it results in better performance and, most importantly, a lower risk of infection – even though the coronavirus pandemic seems to be slowly losing momentum.

To meet this need, we would like to present our new SCHOOLAIR-S-HV floor-standing unit. Supplied ready to operate, this unit can be positioned on any wall, is quick and easy to install and is very efficient thanks to its high air output and heat and moisture recovery. In a nutshell, it provides healthy air in a simple, sustainable and, most importantly, cost-effective way.

We also have a report from the Indoor-Air trade fair in Frankfurt. At this event, the Heinz Trox Foundation hosted a symposium on indoor air quality, which attracted a great deal of attention. And you will find a host of unusual, curious and interesting facts all based around the subject of school.

I hope you enjoy reading this issue.

Yours Udo Jung
TROX Board of Management

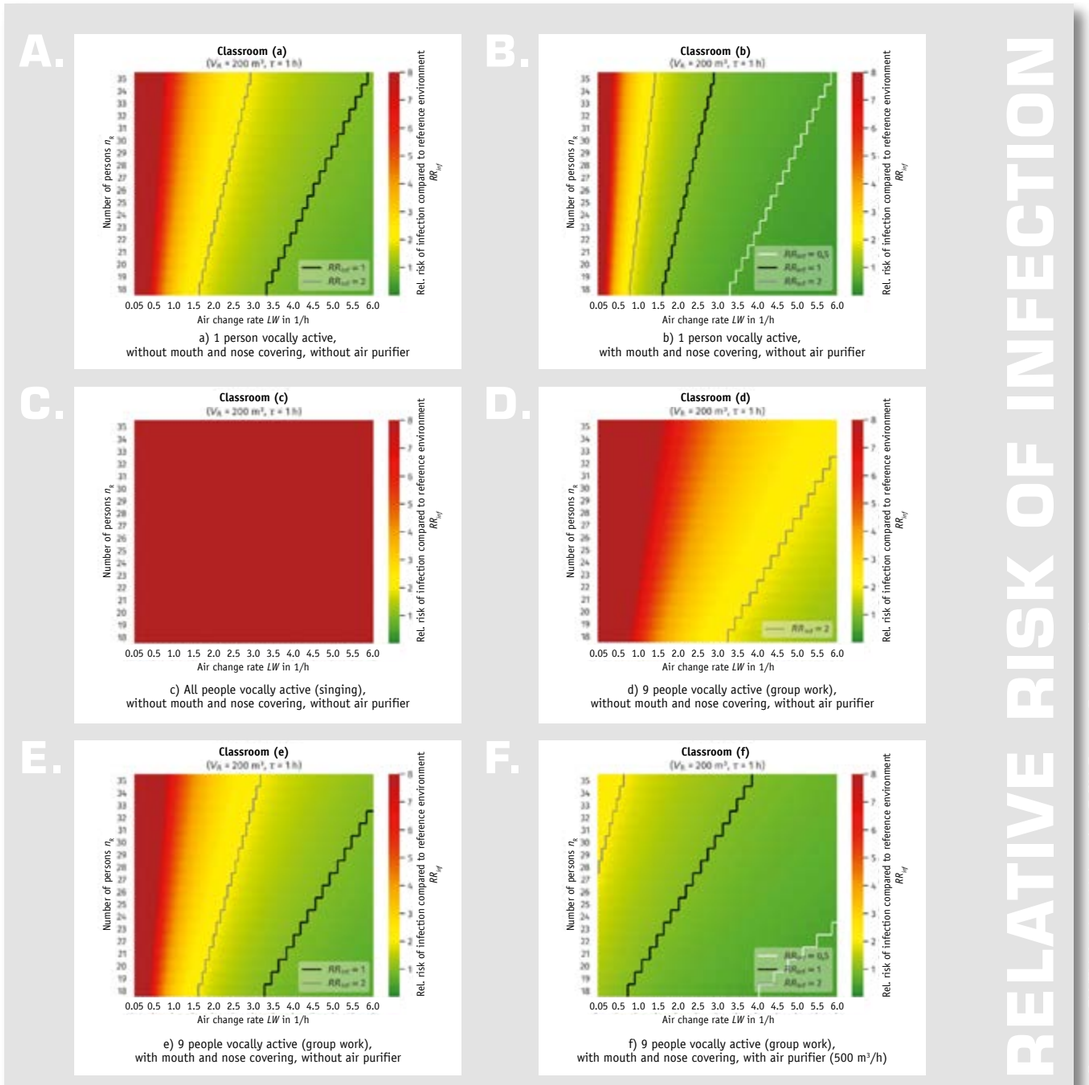
Reduced risk of infection thanks to adequate room air change rate.

The Robert Koch Institute now considers the transmission of viruses through aerosol particles to be one of the main routes to infection. It has been proven that the risk of infection due to aerosols in schools is reduced when there is an adequate room air change rate.

The risk of infection due to aerosols is reduced when there is an adequate room air change rate.

Prof. Müller and his team at RWTH Aachen University have used a methodical approach to predict an absolute risk of infection due to aerosols in any environment in order to then calculate a corresponding relative risk of infection in different rooms for different purposes compared to a reference environment.

Influence of parameters on the relative risk of infection from aerosol particles in a classroom compared to the reference situation.



Source: RWTH Aachen University, E.ON Energy Research Center.

Based on the current proportion of people with COVID-19 in the total population in Germany, researchers can calculate the probability of an infected person being present in the room depending on the specific room occupancy. Based on this probability and on room-specific parameters as well as a hypothetical rate of infectious aerosol particles emitted by an infected person into the room air, it is possible to establish a model for the equilibrium concentration of infectious aerosol particles in the room air.

One of the factors that determine the risk of infection is the viral load.

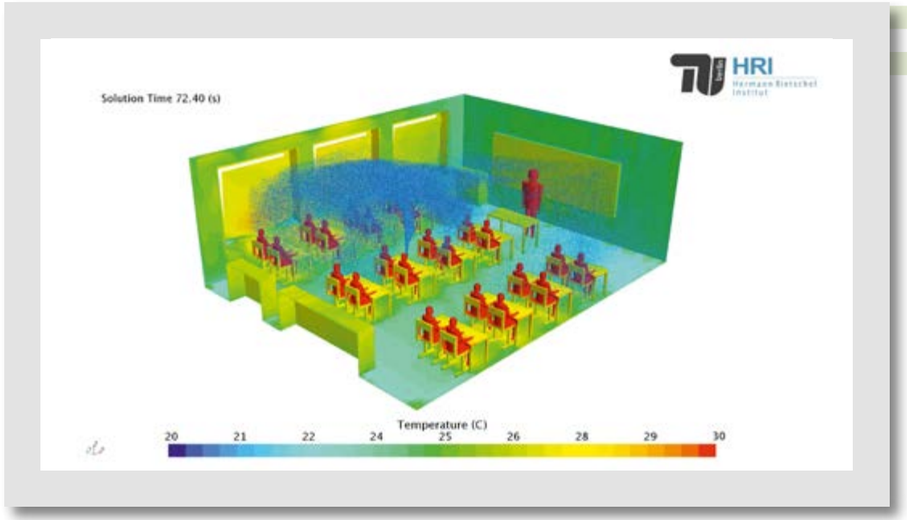
The risk of infection depends on the number of infectious aerosol particles inhaled, the so-called viral load. It also depends on the types of physical and vocal activities being carried out as well as the type of ventilation in use.

The team of researchers investigated how a commercially available mechanical ventilation system, which can be used to define a specific room air change rate, can reduce the risk of infection in a classroom setting, including during break time, compared to opening windows to provide ventilation.

The 'lesson' reference situation used in the study comprises a room volume of 200 m^3, an air change rate of 4.4 h^{-1}, a duration of 60 minutes and the presence of 25 people sitting with one person actively speaking. The resulting volume flow rate corresponds to a specific supply air volume flow rate of 35 m^3/h per person, which is based on the recommended person and area-related airflow of category II according to EN 15251.

A study by the Rietschel Institute shows that large particles fall to the ground, while smaller particles (< 5 µm) heat up and rise upwards, meaning they remain suspended in the air for longer. For this reason, transmission is much more likely through aerosols containing viruses.

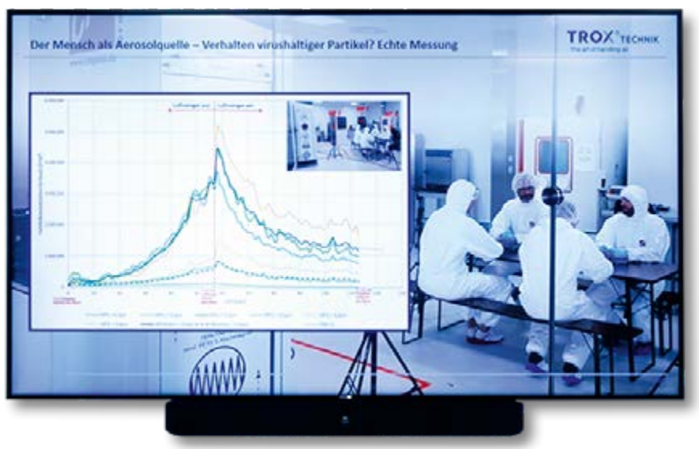
Transmission through inhalation of particles containing the virus. Humans as a source of aerosols (example: school class, open windows).



Source: Technical University of Berlin, Hermann Rietschel Institute.

In the simulation, TROX engineers determined how humans exhale aerosols. They also investigated the influence of an air purifier. For this purpose, four people stayed in an initially virus-free clean room. The CO_2 concentration was then measured as an indicator of the relative risk of infection in the room air, and it was demonstrated how the potential viral load increases over time as a result of exhaling and speaking. An air purifier was then used and measurements confirmed that it could significantly reduce the viral load and keep it at a constantly low level.

In the TROX air distribution laboratory, our engineers simulated how aerosols spread in an enclosed space.



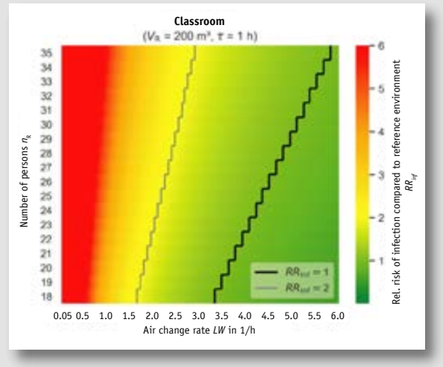
Measurements in the laboratory, which was occupied by four people, showed that the viral load can be significantly reduced with an air purifier.

Relative risk of infection from aerosol particles in different environments compared to the reference environment.

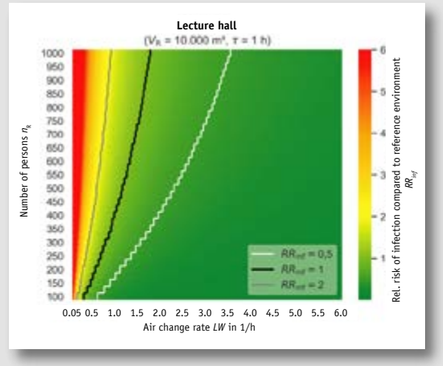
Studies show that the risk of becoming infected significantly decreases when there is an increase in the air change rate. It decreases by a factor of two and a half when a mechanical ventilation system is in place.

In practice, it has been shown that a CO_2 target value (indicator of viral load) of less than 800 ppm should be the aim.

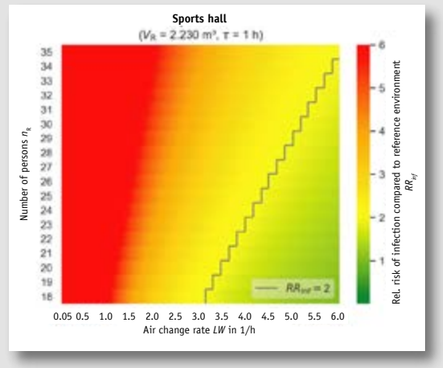
Relative risk of infection from aerosol particles.



CLASSROOM



LECTURE HALL



SPORTS HALL

RELATIVE RISK OF INFECTION

Source: RWTH Aachen University.

Intermittent vs. cross ventilation.

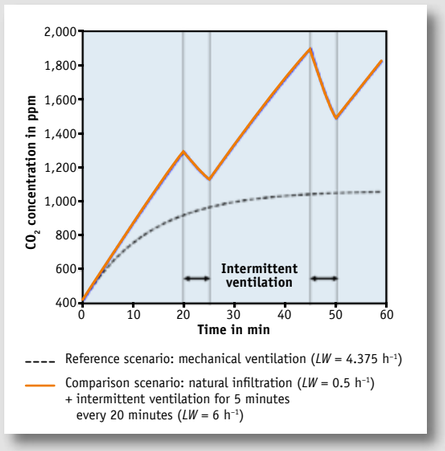
The reference scenarios show that a CO_2 value of 1,000 ppm max. can be maintained with mechanical ventilation and that the risk of infection can be reduced by a factor of two and a half.

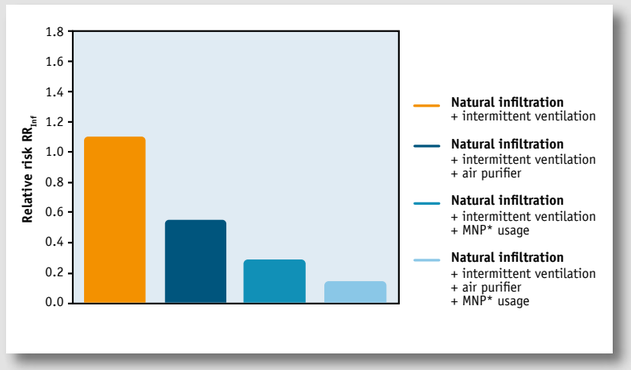
TROX air purifiers.

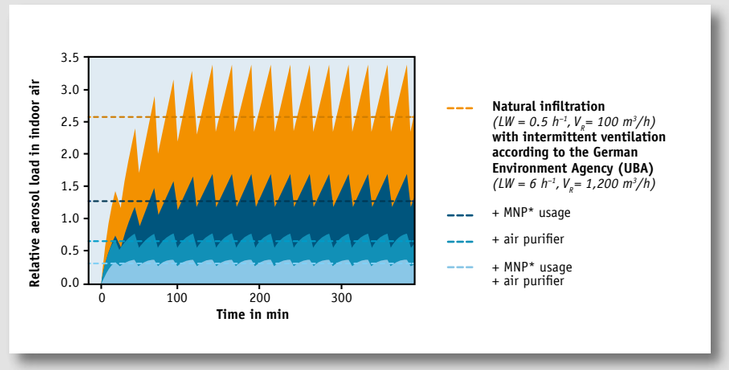
An appropriately sized air purifier is capable of significantly reducing the risk of infection. The TROX air purifier features a high separation rate thanks to an H13 filter and large filter areas, making it very energy-efficient. The fan insulation ensures whisper-quiet operation. However, an air purifier cannot reduce the CO_2 level and does not replace ventilation.

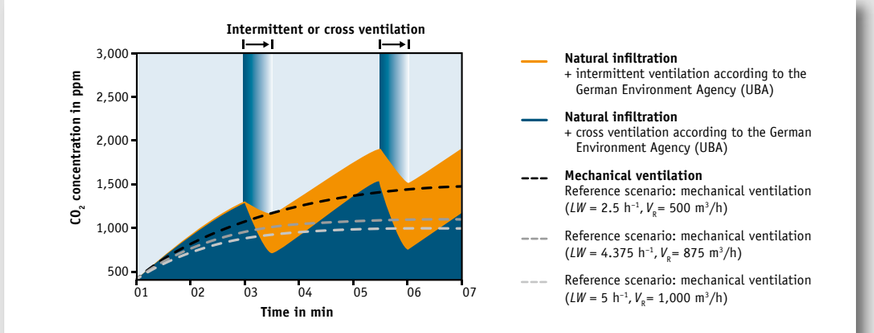
TROX air purifier
Filters 99.95% of all viruses from indoor air.

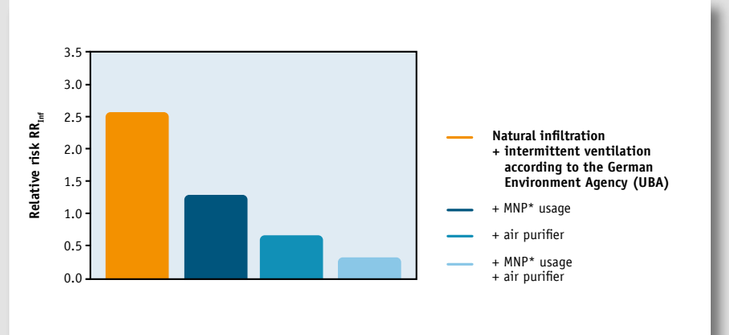
Comparison of mechanical ventilation and natural infiltration with intermittent ventilation in the classroom.











Source: RWTH Aachen University, E.ON Energy Research Center.
* MNP – mouth and nose protection.

= POSITIVE LEARNING OUTCOMES ↑

Equipping schools with mechanical ventilation systems.

The results of the study indicate that equipping schools with a mechanical ventilation system is highly advisable. It comes with other advantages alongside reducing the risk of infection. Noise pollution and air pollution from fine dust and pollen can be avoided thanks to effective filters. An adequate supply of fresh, clean air reduces the CO_2 level in the room and increases concentration. Humidity can be kept at an optimal level and acoustic conditions are improved.

The result: learning improves. A Danish study showed that arithmetic problems could be solved up to 14% faster.

Decentralised ventilation systems make retrofitting much easier and keep investment costs under control. And yet, currently only 10% of schools are equipped with mechanical ventilation systems even though they only cost about 25 cents per student per day to run.

Sources: RWTH-EBC 2020-004, Aachen, 2020, Hermann Rietschel Institute, TROX.

Confirmed by the air conditioning working group.

As a guide for making decisions on efficient ventilation measures in schools, the air conditioning working group has elaborated on the advantages and disadvantages of current ventilation options and the safe operation of ventilation systems in its statement 'Ventilation during a pandemic'.

Its conclusion includes an appeal to decision-makers to systematically stipulate and promote ventilation measures combined with heat recovery.

American study reaches similar conclusions.

In America, a study was instigated by the Lancet COVID-19 Commission and published in April 2021.* It made two key findings.

Firstly, there is a chronic shortage of effective mechanical ventilation systems in schools. The majority of American schools do not even meet the minimum ventilation requirements of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) of five litres per person per second. Measurements taken in 100 US classrooms revealed that a staggering 87 of them were being undersupplied. A study in Texas found similar results.

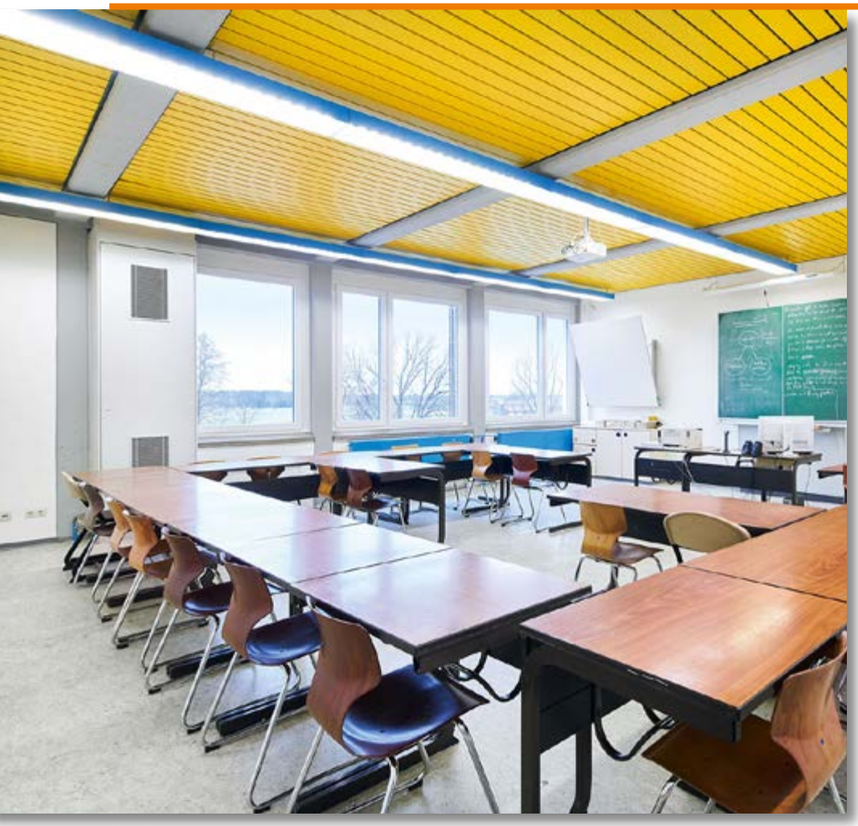
Secondly, measurements in American schools showed that a sufficient supply of filtered outdoor air can significantly reduce the risk of infection. There were also fewer asthmatic symptoms and a 12% reduction in absences accompanied by improved performance when there was a sufficient supply of fresh air.

The Commission is therefore strongly recommending improvements to the provision of mechanical ventilation systems that can help keep schools open or allow closed ones to reopen safely.

* THE LANCET COVID-19 COMMISSION TASK FORCE ON SAFE WORK, SAFE SCHOOL, AND SAFE TRAVEL: Designing infectious disease resilience into school buildings through improvements to ventilation and air cleaning. APRIL 2021.

Learning environment. Indoor air quality as a performance factor.

High indoor air quality in educational settings promotes better learning by increasing concentration, reducing fatigue and headaches and lowering odour levels.



SCHOOLAIR-V vertical ventilation unit at the Paul-Spiegel-Berufskolleg vocational college in Warendorf, Germany.

Prof. Pawel Wargocki and his team conducted research in a Danish school and found that when the outdoor air rate was doubled, arithmetic problems were solved up to 14% faster on average.

Highly satisfied teachers and students.

People are simply more motivated and focused when they work in a comfortable environment. And satisfaction increases as the outdoor air rate increases. Clean, filtered air also prevents illnesses, which results in fewer absences. Filtering out pollen and germs results in fewer allergies and infections. And removing particulate matter prevents adverse health effects in the long term.

Top marks for ventilation and air conditioning systems.

When discussing the use of ventilation and air conditioning systems in schools, Prof. Werner Jensch from Munich University of Applied Sciences likes to quote a head teacher whose school has an old building without ventilation and a new building with ventilation: 'The children in the new building perform on average half a grade better than those in the old building.'

In this project report, we will be presenting two refurbishment projects in the school sector that involved retrofitting decentralised mechanical ventilation systems. We will then discuss the numerous options available for reliably supplying air to educational facilities.

Refurbishment of the Paul-Spiegel-Berufskolleg vocational college in Warendorf, Germany.

The Paul-Spiegel-Berufskolleg vocational college started out as a training school for skilled trades in 1856 and has continued to develop over the course of many decades. Today, it offers a wide range of part-time and full-time courses. Students can obtain many different academic and vocational qualifications at Paul-Spiegel-Berufskolleg vocational college, while a variety of projects and a high proportion of hands-on training provide students with direction and increase their chances of succeeding in their chosen career.

The construction project involved the refurbishment of the existing building in several construction stages. During the design stage, decentralised ventilation units from the TROX SCHOOLAIR-V series (vertical under-sill ventilation unit) were identified as the perfect solution, not least because they could be easily integrated into the existing building thanks to their minimal space requirements.

Technology for optimum indoor air quality.

For this purpose, a narrow window element was exchanged for an opaque element for air distribution, the existing sill was adapted to the unit height and finally an outer casing was chosen to match the room's design. All units were placed half on the sill and half on a support structure and were connected to the power and water supply. Master and slave units are connected with a patch cable for internal communication. The control panel was also connected to the master units.

With a nominal air volume flow of 320 m³/h, the units provide enough fresh air to achieve the best possible learning outcomes. Equipped with an outdoor air filter with filter class ePM1 65%, the units ensure that fresh, pollutant-free air enters the classroom. Each room is equipped with two units that are connected in a master-slave network. Optimum indoor air quality is maintained by integrated VOC sensors that permanently monitor the indoor air. The outdoor air volume is adjusted according to the threshold values

Paul-Spiegel-Berufskolleg vocational college in Warendorf, Germany: narrow window elements have been replaced with opaque elements for air distribution.

that have been specially adapted for this project. If the indoor air quality is within the optimum range, the units switch off or switch to secondary air mode if they are still required for heating operation.

Energy-efficient temperature control.

Temperature is another important factor alongside high-quality air. Controlling the room temperature is therefore another key task performed by the ventilation units. For this reason, there are air/water heat exchangers in the units that control the supply air according to the room temperature requirements. The room temperature is measured in the control panel, which is connected to the master units. Users can also configure their own settings to suit their personal preferences.

TROX SCHOOLAIR-V-HV
Rotary heat exchanger
for heat recovery.

The units are equipped with a heat recovery unit to increase energy efficiency, which keeps water-side output to a minimum. Of course, the heat recovery unit can be bypassed to allow for night purge in the summer, for example.

Front/back
All components and individual room controllers integrated in one casing.

Fully convinced by the concept and the positive experiences of the initial stages, all further construction stages were carried out in the same way. Since in some cases there were years between these stages and the technologies being used were constantly being further developed by TROX, it has been possible to install SCHOOLAIR-V-HV units. This new type of decentralised ventilation unit delivers approx. 50% more fresh air with the same acoustics and further improves indoor air quality. They also have a rotary heat exchanger for heat recovery, which brings together many advantages. Its particularly high heat recovery efficiency improves energy efficiency, and a rotary heat exchanger can also be used all year round. This means that there is no need to reserve the heating load for bypass operation in the event of a risk of freezing and the heating system can be made smaller.

The principle of operation offers a unique advantage:

The water contained in the extract air condenses in winter and is absorbed by the supply air. This has a positive impact on indoor air humidity and promotes well-being while protecting against infections. The integrated controller variably adjusts the heat recovery efficiency to achieve the correct supply air temperature downstream of the rotary heat exchanger for heat recovery, which minimises use of the heating/cooling coils.

Customised control.

The control options for the units are as diverse as the range of courses offered by this school. The units can be easily adapted to the user behaviour with individual schedules. Individual settings can be configured via control panels. Prior to delivery, project-specific features are stored in the software. This means that the school has received the exact solution that the district of Warendorf and, in particular, the teachers and students had envisaged. In modern schools, ventilation is a contributing factor to a successful learning experience – and this is only natural.

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The Marienfelder Grundschule primary school was refurbished from the ground up and equipped with modern ventilation units.

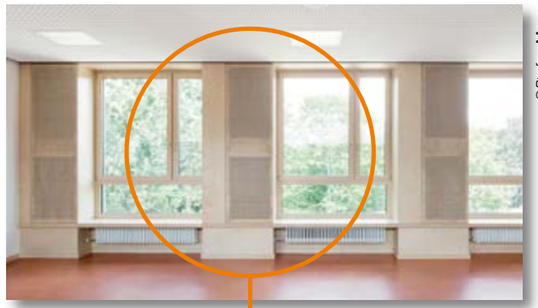
Ground-up refurbishment of a Berlin school building from the 1970s.

The Marienfelder Grundschule primary school is an all-day school in Berlin that has two main priorities: social interaction and democratic teaching practices. This means that everyone at the school should feel comfortable and that the ‘fair school’ principle is applied. In this respect, the conscious decision to include the district in the school’s name reflects its affiliation with the catchment area.

The main building, which dates back to the 1970s, has been refurbished from the ground up and has been made fully accessible. This involved eliminating fire safety deficiencies and improving the building’s energy performance – while at the same time increasing the amount of natural light entering the building and improving the indoor air quality. The façade was dismantled down to the supporting structure and replaced by modules in a timber panel construction.

Funding programmes, such as the Berlin Sustainable Development Programme (BENE), set strict criteria for the ventilation units. For example, the heat recovery function integrated into the units had to have a heat recovery efficiency of at least 80%. TROX SCHOOLAIR-V-HE decentralised ventilation units, which clearly exceed this requirement with a heat recovery efficiency of 84%, have been installed in the classrooms. This high efficiency not only helps to improve energy performance, it also reduces the amortisation period. Thanks to their compact base area of just 600 x 400 mm, the units could be easily installed on the sill and integrated into the room’s design.

Façade-integrated ventilation units provide sufficient air exchange and healthy air in the classrooms.



They blend harmoniously into both the interior and exterior design and are accessible from both sides.

©Stefan Meyer

The main task of the SCHOOLAIR-V-HE decentralised ventilation units is to ventilate the classrooms. The central idea here is: better learning is achieved with fresh air. As studies show, when the air change rate is increased from 21 m^3/h/person to 30 m^3/h/person, the standard performance of students increases to 105%. In the light of these results, three units were installed in one classroom. The master-slave connection ensures that all devices behave identically.

The units offer additional benefits: the room temperature can be kept at a comfortable level all year round and pollutants such as dust or pollen are effectively filtered out of the air. Disruptive outside noise is minimised, which optimises the acoustics. Speech remains audible at all times, making it easier for students to follow their lessons.

The units offer a clear advantage, especially during a pandemic: the constant exchange of room air thanks to a supply of fresh air can significantly minimise the risk of infection, and the three units can effectively help with compliance with COVID-19 workplace ventilation regulations, provided that rooms are occupied appropriately.

In the following, we will elaborate on the many options available for reliable air supply in educational facilities.

Criteria when selecting an indoor air system.

The ventilation and air conditioning strategy for an educational facility depends on many factors. It begins with structural conditions, such as the architecture, building envelope, location and orientation of the building, room capacities and depths as well as the room layout and much more. Next, occupancy of the rooms, loads to be dissipated and the usage and furnishings in the rooms all play an important role. And finally, the ventilation and air conditioning design depends on whether it is a new building or a refurbishment project. Existing buildings, i.e. ventilation and air conditioning refurbishment projects, obviously do not allow for the same degree of planning freedom as new builds. In these cases, for example, façade-integrated decentralised ventilation units are an ideal solution.

The wide spectrum of ventilation and air conditioning systems, units and components puts TROX into a unique position: being able to provide a bespoke solution for different conditions and requirements in any educational facility. The wealth of tried-and-tested solutions and the vast experience of TROX engineers acquired over decades in a wide variety of projects worldwide mean that we can provide our customers with customised solutions and holistic concepts for future-oriented ventilation and air conditioning and high indoor air quality.

Indoor air conditioning has to meet many and diverse requirements:

- Sufficient air exchange ($CO_2 \leq 1{,}000$ ppm) and guarantee of perfect climatic conditions (room humidity, room temperature)
- Demand-based control for energy-efficient operation and individual control to create a high thermal comfort level
- Supply of air with as little turbulence and noise as possible to occupied zones
- Low background noise and effective attenuation of outside noise
- Separation of fine dust, pollen and other outdoor air pollutants
- Efficient system operation under all operating conditions thanks to standardised, safe control systems with intelligently integrated components
- Utmost safety in the event of a fire

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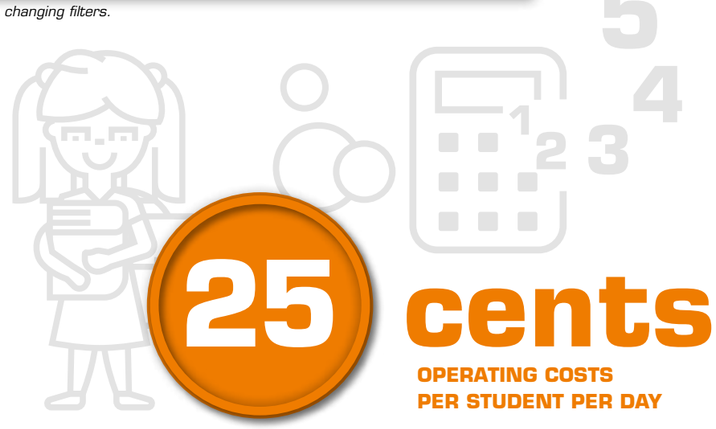
Easily accessible modules. Helpful, for example, when changing filters.



Huge energy saving potential.

Operating costs in educational facilities amount to €5,000 – €6,000 per student per year. In view of the large number of educational facilities and their high energy requirements, every kilowatt hour saved is a valuable contribution to Germany's energy transition. However, investments in high-quality air amount to just over €40 per pupil per year, which is less than 1% of operating costs. Investments that pay for themselves.

It is time to install energy-efficient systems for ventilation and air conditioning and, above all, to refurbish old, energy-sapping buildings.

X-SENS for measuring and recording various measured quantities (e.g. temperature, humidity, air quality) and conditions for systems for single room control and central control. The X-SENS-TEMP-RH-EXH combination sensor is a control component to be integrated into control systems. It consists of two sensors for measuring the temperature and relative humidity.

Flow-optimised air terminal devices in energy-efficient air/water systems that dissipate high heat loads also offer huge savings potential. Efficient EC fans and heat recovery systems that use the energy of the extract air bring additional energy savings.

Refurbishment backlog in educational institutions.

Around half of all schools and pre-schools in Germany are in need of refurbishment. The ambitious targets, set by climate policy, can only be achieved by pushing forward the energy-efficient refurbishment of public buildings, which still constitute 40% of primary energy consumption. Energy-efficient refurbishment of educational establishments would have a far more wide-reaching effect than just saving energy: a noticeable increase in performance. Together with thermal insulation measures, the mechanical ventilation of classrooms is becoming an obligatory task.

Demand-based control of airflows for centrally controlled ventilation solutions.

The occupancy rate of classrooms, staff rooms, corridors and auditoriums fluctuates. They are also not being occupied all of the time. When it comes to central ventilation solutions, ventilation systems need to be controlled based on demand to ensure that they operate in a way that conserves energy. VOC sensors indicate occupancy levels. If only a few or no people are present, a larger proportion of extract air can be recirculated into the ventilation system. As more people enter the room, the proportion of recirculated extract air is reduced, and the proportion of fresh air is increased. With heating mode during the night, the supply air is 100% recirculated air.

Motion detectors include a PIR sensor (passive infrared) for detecting people in a room, i.e. occupancy. The condition (i.e. if the room is occupied or not) is transmitted to the control system via a volt-free digital output.

CENTRAL

Central ventilation concepts.

Air handling unit for efficient indoor air management.

The air handling unit is the centrepiece of a central ventilation system. TROX X-CUBES permanently and reliably supply rooms with treated outdoor air, and they have also been enhanced by a smart function.

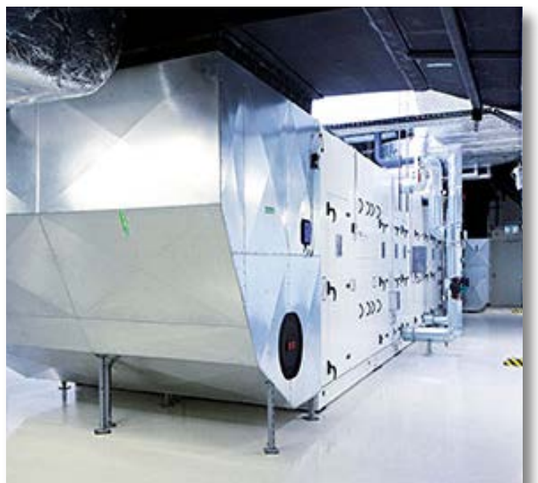
The air handling unit can act as the centre of the automation network within the ventilation and air conditioning system and can also serve as a management system for smaller buildings. X-CUBE Control in the air handling unit collects and evaluates all data for the ventilation and air conditioning system with regard to its functions and their optimisation. The number of communication interfaces and data points on the central BMS can therefore be drastically reduced, just like the effort required for installation and commissioning.

Our service – your benefit:

- Expert consultancy and support throughout all stages of a project: from the design stage to handing over the system, and also after installation
- Comprehensive service support: commissioning, system integration, maintenance and modernisation
- Easy connection to higher-level systems due to standard interfaces
- Maximum data transparency due to open systems such as LonWorks, Modbus and BACnet
- Air management system solutions from a single source reduce the number of interfaces required
- Reduced fire load thanks to bus systems that require significantly less wiring
- Support of flexible building usage: systems can easily be adapted to meet new requirements
- Amortisation of investment costs thanks to reduced operating costs
- Energy savings due to optimised systems operation
- High level of operational reliability due to system self-monitoring

Complete ventilation and air conditioning systems from a single source.

TROX has set itself the goal of minimising interface issues with regard to components and trades. This is why we offer almost all ventilation and air conditioning components, units and systems from a single source: from air handling units to air terminal devices, automation and communication systems, and connection to the central BMS (central building management system). The decisive advantage for specialist consultants and HVAC contractors is the fact that they have only one point of contact; this reduces the communication and coordination effort considerably.



TROX X-CUBE air handling unit.

Effective, efficient filter systems remove high levels of particulate matter.

The equipment which includes single or two-stage filters, depending on the outdoor air conditions, ensures that fine dust and pollen are effectively and efficiently separated. Of course, educational facilities also want filter systems to be cost-effective. For this purpose, TROX has developed an LCC analysis tool which considerably simplifies the process of selecting the best filter for an application.

Comfortable and efficient air distribution – flexible on-demand ventilation.

If very diverse architectural and usage parameters need to be considered in the ventilation and air conditioning design process for a room, variable volume flow control is the best solution. This control strategy allows airflows to be variably adapted to fit room usage scenarios. The automatic adjustment to changing parameters thanks to intelligent control and communication systems increases the efficiency of a system considerably.

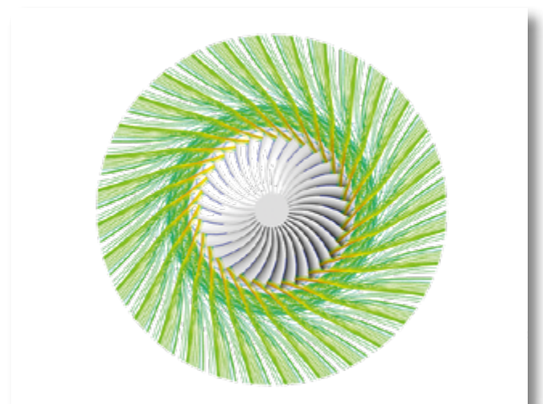
Flow-optimised air terminal devices.

Aerodynamically optimised air terminal devices are extremely important to TROX. Excellent aerodynamic properties ensure maximum thermal comfort by quickly dissipating high airflow velocities and high temperature differences. This is particularly the case with mixed ventilation solutions, where often only one unit is used per classroom. When using displacement ventilation systems, TROX recommends working with at least two units per classroom in order to supply everyone with enough fresh air.

Effective filter systems separate fine dust and pollen.

TROX LCC analysis tool
Scan the QR code
to find a suitable filter.

The filter energy costs calculator calculates the energy costs for a filter in a ventilation and air conditioning system as well as the savings potential at the click of a button.



The air control blades of the AIRNAMIC ensure maximum comfort through homogeneous air supply and the rapid reduction of temperature differences and airflow velocities.

Decentralised ventilation concepts.

SCHOOLAIR-HV – decentralised ventilation.

Decentralised ventilation concepts.

Decentralised ventilation and air conditioning systems installed in or on the façade or sill or in the ceiling have a number of benefits with regard to design, flexibility and economy. The units facilitate noise controlled air handling via the shortest possible route directly through the façade from the outside to the inside and vice versa, in line with the structural or design conditions. This is why they offer the greatest possible flexibility and maximum energy efficiency.

Decentralised ventilation units are a sustainable solution to create a positive learning environment.

TROX SCHOOLAIR units ensure the best indoor air quality at ideal room temperatures in classrooms, staff rooms and also in pre-schools by permanently supplying fresh air – energy-efficiently, quietly and with little installation effort.

A regular supply of fresh air and constant air exchange are the surest way to prevent the spread of viruses in indoor air. TROX SCHOOLAIR maintains constant air exchange even when the windows are closed, providing effective virus protection.

Better learning environment.

Mechanical ventilation works as quiet as a whisper. Noise from the outside is suppressed. In addition, the CO_2 content in the air is reduced. Students breathe fresh, virus-free air. This allows them to concentrate more on their work and they are rarely ill. TROX SCHOOLAIR ventilation units heat the supplied fresh air to the desired temperature – and consume only half as much electricity as a standard laptop thanks to efficient heat recovery.

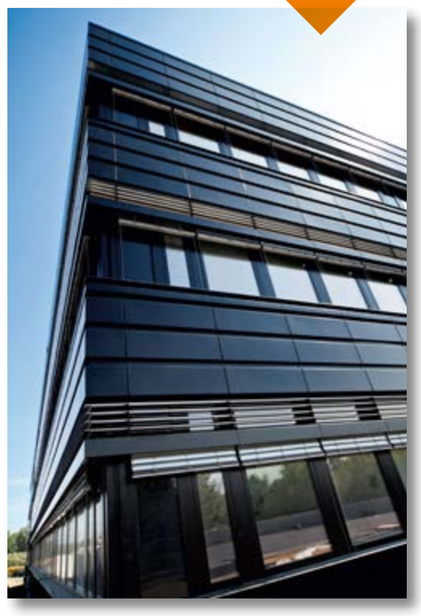
Teachers can adjust the output directly in the room using the operator controls. For example, to increase the air output during breaks using the 'intermittent ventilation' function.

Easy to retrofit.

TROX SCHOOLAIR is a decentralised system. The unit is mounted in the room concerned close to the external wall and supplied with fresh air via a small wall opening or a window. This means that TROX SCHOOLAIR can be retrofitted as required with minimal effort.

SCHOOLAIR-V-HV

SCHOOLAIR-B-HV



SCHOOLAIR-D-HV

Decentralised ventilation units.

Fresh air is heated in winter and cooled in summer (cooling function is optional). Since classrooms usually have room depths of less than 7 metres, comfortable ventilation and air conditioning is guaranteed. Quiet EC fans and integrated heat recovery, which uses the heat of the extract air, also increase the efficiency of the system.

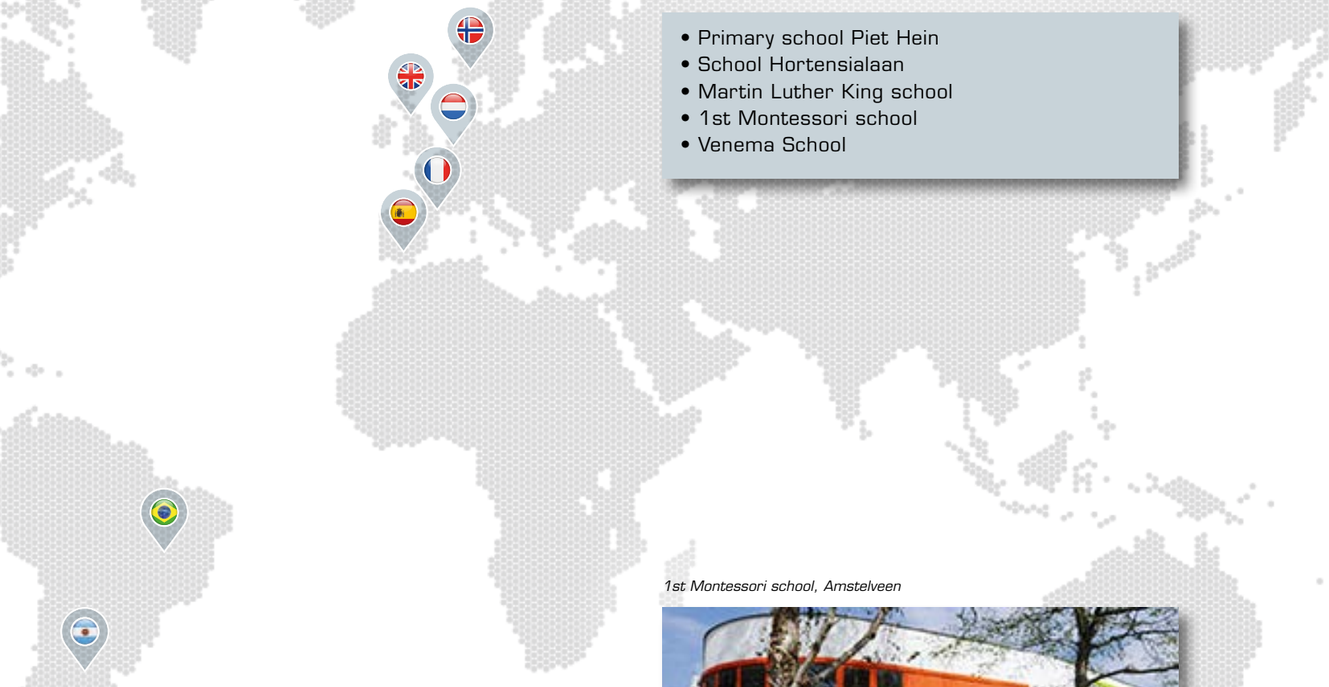
Decentralised ventilation units:

- Horizontal under-sill units
- Vertical under-sill units
- Ceiling units
- Floor-standing units (see p. 60)

INTERNATIONAL

TROX technology is setting standards internationally.

TROX ventilation systems are providing healthy air all over the world. They are creating significantly better learning environments in educational facilities, demonstrate high energy efficiency and blend harmoniously into the building's architecture. Here are some examples:



The Netherlands.
High demands on ventilation systems.

The Netherlands requires air exchange in classrooms to limit CO_2 pollution in the air. As a general rule, an air change rate of 950 m^3/h/person is assumed for an occupancy rate of 30 persons. The municipality of Amstelveen takes these regulations very seriously. In recent years, it has equipped the following schools with TROX systems, with a focus on demand-based air supply:

- Primary school Piet Hein
- School Hortensialaan
- Martin Luther King school
- 1st Montessori school
- Venema School

1st Montessori school, Amstelveen

Brazil.
Air purifier successfully tested.

At the SESI-SP primary and secondary school in Osasco with 1,894 students and 42 classrooms, the air quality in classrooms was examined with and without TROX air purifiers in a pilot project in June 2021. The room without air purifier had the same size, the same number of students in the same age group and was used in the same way as the classroom with the air purifier. Both rooms were air-conditioned and not supplied with fresh air for the duration of the test.

The measurements and analyses carried out by an external laboratory team delivered clear results: bacteria, mould and fine dust concentrations were significantly lower in the classroom with the TROX air purifier, and the air quality was much better than in the other room.

At the same time, TROX Brasil received an order to install TROX technology at the Einstein University School, one of the most prestigious institutions for medical studies in Latin America.

SESI-SP, Osasco, Brazil

Spain.
Efficient ventilation technology in universities and schools.

In the heart of Madrid's financial district stands the Caleido Tower, the first vertical campus in Europe – a 35-storey tower equipped with TROX components that will house 64 classrooms with a capacity for more than 6,000 students and 500 employees.

The campus in Pozuelo, Madrid, has space for 4,000 students and is one of the largest entrepreneurship hubs in Spain.

The Gabriel de Morales School in Melilla is a new educational centre for children aged three to twelve.In addition to the classrooms, TROX ventilation systems also supply the library, music room, computer room, dining hall, kitchen, sports hall and office area with healthy air.

Special educational facility projects
by TROX in Spain:
- ESIC University in Pozuelo, Madrid, for 4,000 students
- Institut de Vilablareix, Girona, 4,638 m^2 overall area
- American School of Madrid in Pozuelo, Madrid
- German School of Bilbao in Pozuelo, Madrid

IE University in the Caleido Tower, Madrid. The first vertical campus in Europe.

INTERNATIONAL

France.
Better air quality and lower power consumption.

The project with the aim of creating a new generation of schools in Var includes three major initiatives: the construction of the Collège Geneviève De Gaulle-Anthonioz in Carcès, and the reconstruction and restructuring of the Collège de l'Estérel in Saint-Raphaël and the Collège Jean l'Herminier in La Seyne-sur-Mer. These three construction projects have been planned as part of the first public-private partnership of the Département du Var according to the Mediterranean Sustainable Buildings approach (BDM). The BDM is a French environmental quality assurance system launched in 2008 that evaluates construction and refurbishment projects in a continuous improvement process using a participatory guarantee system.

Special educational facility projects
by TROX in France:
• École du Futur, Dirac
• CFA, Mont-de-Marsan

Norway.
Healthy air and effective fire protection.

Campus Ås, a 63,100 m² veterinary facility, is part of the NMBU in Norway and is used for lectures, research and veterinary activities. The entire building is designed and built to prevent the spread of viruses, bacteria and parasites between rooms and from the inside of the building to the outside. At the same time, the coloured ventilation elements perfectly complement the room design.

Hoppern Skole is a 9,900 m² school built to passive house standards and certified as 'Very Good' by BREEAM-NOR for its indoor air quality, among other factors. Due to the large amount of solid wood used, it was also important to have adequate fire protection. TROX Auranor supported this with the AURASAFE control system and the FKRS-EU and FKR-EU fire dampers.

United Kingdom.
Better and healthier learning in educational establishments.

Many universities and schools in the United Kingdom rely on TROX to ensure effective air exchange in classrooms and halls in order to provide a healthy environment for their students that is optimised for academic performance.

Special educational facility projects
by TROX in the United Kingdom:
• Derby Cathedral School, Derby
• Avanti Fields School, Leicester
• AL-HURAH School
• The Northern School of Art, Middlesbrough

Argentina.
Conditioned and filtered indoor air in schools.

In the school sector, TROX ventilation and air-conditioning technology ensures well air-conditioned and ventilated rooms in new buildings as well as in existing ones. In order to provide their students with better indoor air quality and to minimise the risk of infection in the wake of the coronavirus pandemic, the city of Buenos Aires has ordered TROX air purifiers with HEPA 13 filtration for a number of its educational facilities.

Special educational facility projects
by TROX in Argentina:
• GCABA Schools, Buenos Aires
• Technical School No. 5, Buenos Aires
• Northlands School, Buenos Aires Province
• Escuela normal Dr. J. Alfredo Ferreira, Esquina

Bibliothèque Université Grenoble Alpes, Grenoble

Campus der NMBU, Ås

Avanti Fields School, Leicester

GCABA Schools, Buenos Aires

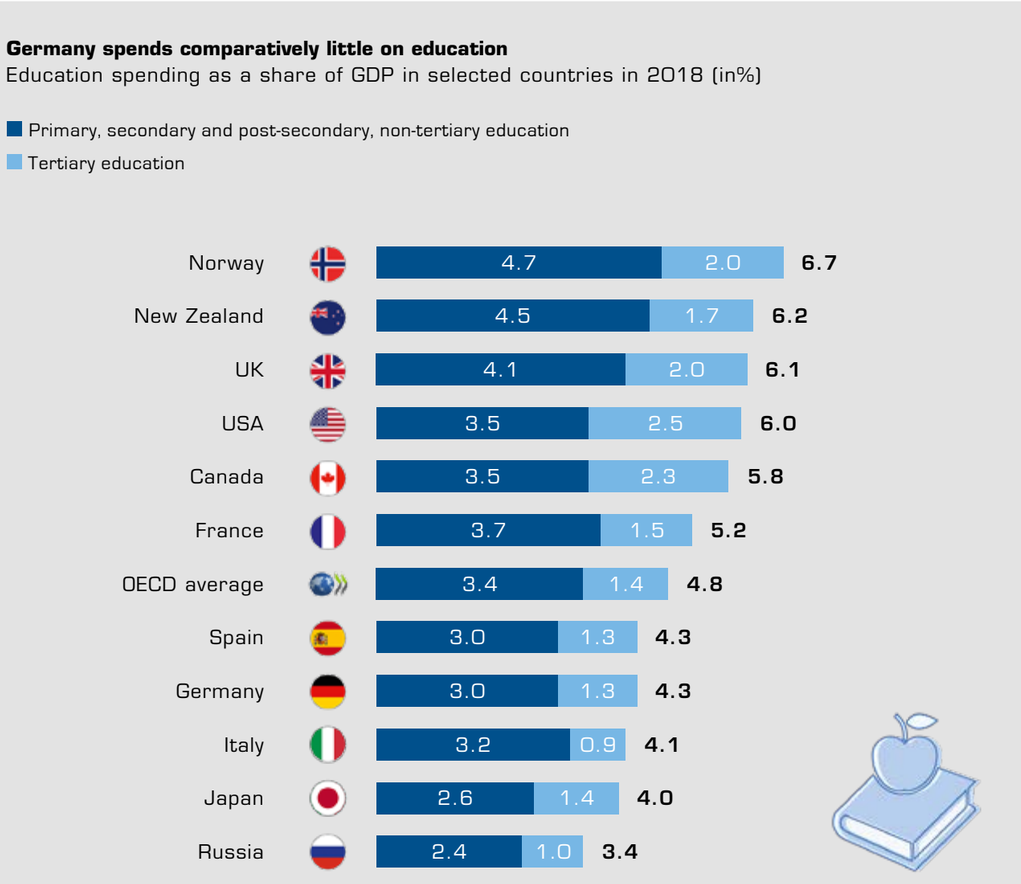
The future of education policy?

Education is the future. Education is a crucial economic factor. Education increasingly determines individual opportunities in life, a generation's well-being and the future of modern societies.

Is the commitment to invest in education a promise that is not being kept?

It is surprising that spending on education policy is still relatively low in many countries. Leading the way are Norway with 6.7% of GDP, New Zealand with 6.2% and the UK with 6.1%, closely followed by the USA with 6.0%. Germany is clearly lagging behind with just 4.3%. In Europe, it is mainly the Nordic countries that are out in front, which is also reflected in the PISA results.

Germany spends comparatively little on education
Education spending as a share of GDP in selected countries in 2018 (in%)



‘There is only one thing in the long run more expensive than education: no education.’

John F. Kennedy

Digitisation in education.

Digitisation is becoming a game changer in education. Those who fail to take advantage of this trend will miss out on future opportunities. Compared to other countries, Germany has a lot of catching up to do in terms of providing digital equipment for schools and students. According to a special analysis of the latest PISA results, it was lagging far behind in 2018.

There should be a computer for every student in every school. In Germany, the figure is just 0.61 computers per student. This puts Germany far below the average value in OECD countries of 0.85 computers per student.

Countries such as Luxembourg are way ahead, with schools having 1.6 computers per student. In the USA and the UK, the figure is 1.5, which means that each student has access to more than one device. The situation is even more shocking when you consider the proportion of laptops and tablets, i.e. portable computers. Home-schooling has been extremely important over the past few years.

PISA evaluation shows: Northern Europe is ahead of everyone else when it comes to digitisation.

In Swedish schools, practically all devices are mobile; in Denmark it is a solid nine out of ten. In both countries, significantly fewer students needed to rely on their own family’s resources during school closures due to coronavirus lockdowns.

In Germany, only 33% of students had access to an online learning platform at the time of the PISA survey, compared to an OECD average of more than 54%. Germany therefore ranked in the bottom group – even behind Moldova, which came in at around 40%.

In Singapore, some Chinese metropolises and Denmark, more than 90% of students reportedly already had access to learning platforms in 2018. Asia is way out in front. When it comes to digital professional development for teachers, schools in Singapore, for example, were in the top position with 90%.

Spending on education, digitisation. Politicians make a lot of promises. Do they keep them?

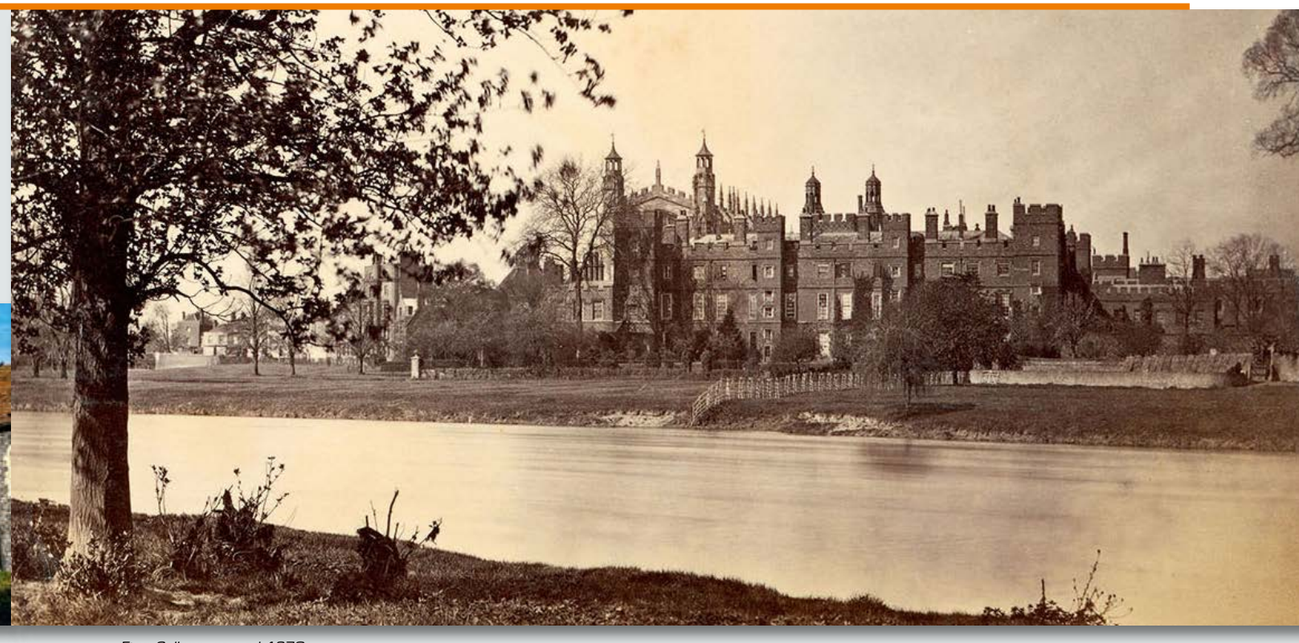
A tricky concept to grasp: education is the future and politicians are oblivious! As John F. Kennedy said: ‘There is only one thing in the long run more expensive than education: no education.’

Unique schools.

The smallest, the largest, the most unusual, the most expensive or the most elevated schools. Celebrities who used to be teachers in their former lives. Our highlights feature interesting facts and statistics about education.

The King's School in Canterbury.

The King's School in Canterbury was founded in 597, over 1,400 years ago, and today teaches over 900 students. It is one of the oldest schools in the western world.



Eton College, around 1870.

Unusual schools.

Mid-Cave Primary School in Dongzhong: This village in the Chinese province of Guizhou is affected by extreme poverty; there is no money for a 'proper' school. So, a school was hastily set up in the middle of a cave in 1984. However, the Chinese government had it closed in 2011.

Schulfarm Insel Scharfenberg school in the middle of Lake Tegel in Berlin is a state-run secondary school with an affiliated boarding school and an unusual teaching concept. Numerous animals on the school farm provide many opportunities for hands-on agricultural experiences.

Monument Valley High School in Kayenta, Arizona, is located on a Navajo reservation near the Utah state border – in the middle of the world-famous Monument Valley. Students looking out of the window can see the familiar reddish mesas that provide the picturesque backdrop for many western movies.

Monument Valley.

Unique schools around the world.

The smallest school is a primary school in Alpette, 66 km north of Turin. Isabella Carvelli (33), the only teacher, teaches year-three student Sofia all subjects.

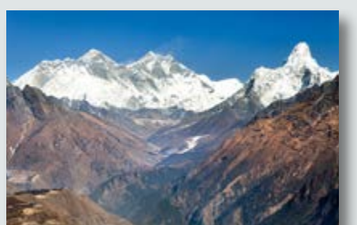
The largest school is located in Lucknow, Uttar Pradesh, India. The City Montessori School (Hindi: सिटी मॉन्टेसरी स्कूल, लखनऊ) is a private Montessori school with around 51,000 students and 2,500 teachers.

The most elevated school, Pumajiangtang primary school, is situated at an altitude of 5,573 metres in the north of the Himalayas.

The title of 'most famous boarding school' probably belongs to Eton College in Berkshire. The school was founded in 1440 by Henry VI – for children from poor families. Today, members of the royal family such as Prince Harry are among its most famous school leavers.

The most expensive school is located in Switzerland on the shores of Lake Geneva. It costs parents almost €100,000 a year. Graduates of the Le Rosey Institute include the Shah of Persia, Prince Rainier III of Monaco and former King of Egypt Farouk I.

The Himalayas.



Prince Rainier III of Monaco.

Farouk I of Egypt.

Famous teachers.

Many Hollywood greats, popstars and famous authors used to be teachers in their former lives.

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Joanne K. Rowling
moved to Portugal at the age of 26 to teach at the Encounter English School in Porto.

©Featureflash Photo Agency/Shutterstock.com

Stephen King
taught English in Hampden, Maine before he started writing scary stories.

©Stasia04/Shutterstock.com

©leirbagarc/123RF.com

©Kraft74/Shutterstock.com

Sylvester Stallone
worked as a PE teacher before embarking on his film career.

©zixia/123RF.com

Sting
trained as an English and music teacher at the Northern Counties Teacher Training College. He then taught for two years at St Paul's First Catholic School in Cramlington, England, before starting a career as a musician.

©Anton Gvozdikov/Shutterstock.com

Hugh Jackman
was a PE teacher at Uppingham School in Rutland, England.

The ten highest IQs.

• Mathematics professor Terence Tao	**230**
• Writer Marilyn vos Savant	**228**
• Engineer Kim Ung-Yong	**210**
• Physician Sho Yano	**(estimated) 200**
• Psychiatrist Evangelos Katsioulis	**198**
• Economist Christopher Harding	**197**
• Businessman Walter O'Brien	**197**
• Computer scientist Thomas Wolf	**196**
• Autodidact Christopher Langan	**195**
• Screenwriter Rick Rosner	**192**

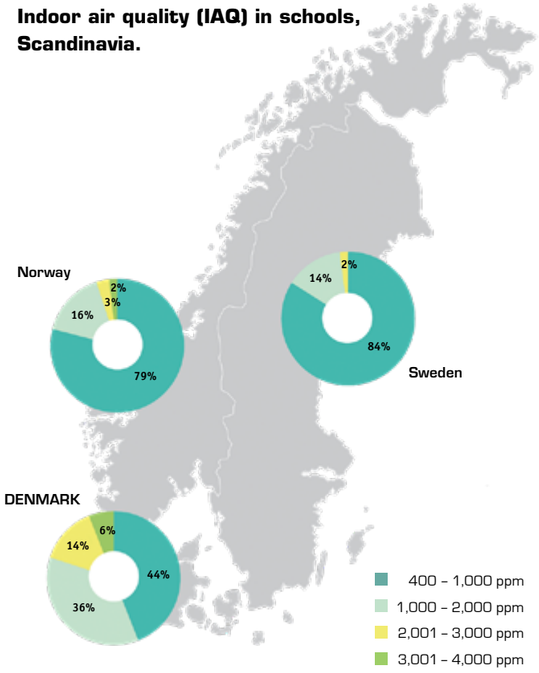
It is interesting to note that the masterminds listed here are relatively unknown. Where are geniuses such as Albert Einstein or Stephen Hawking? In fact, these two allegedly had an IQ of 'only' 160.

Half of the population has an IQ between 90 and 109. Anyone who achieves more than 140 is considered a genius. This is achieved by just 0.1% of the human population.

The positive impact of effective ventilation in Scandinavian schools.

At the Heinz Trox Foundation symposium 'Aachen Day of Air Quality and Sustainability in Schools' in September 2021, Professor Geo Clausen gave a lecture on the ventilation conditions in Scandinavian schools and the effect of adequate air exchange on the learning and health of students. The latter being a particularly important aspect to consider, especially during a pandemic. We have summarised the most important points and findings compiled by his team in Scandinavian schools.

Indoor air quality (IAQ) in schools, Scandinavia.



A key predictor of indoor climate issues in schools is a lack of a mechanical ventilation system. In his lecture, Professor Geo Clausen explained that it is difficult to achieve adequate air exchange simply by opening the windows.

Professor Geo Clausen is Head of the Indoor Climate Department in the Environmental and Resource Engineering Faculty at the Technical University of Denmark.

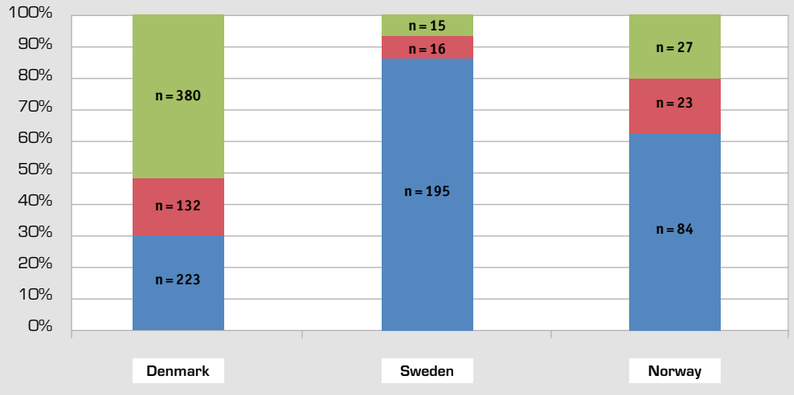
IAQ at Danish schools.

In a study of the indoor climate in 245 Danish classrooms, high CO_2 concentrations exceeding the recommended levels of 1,000 ppm were measured in nine out of ten classrooms.

IAQ in Scandinavia.

In another study, students in more than 700 Danish classrooms measured the CO_2 concentration themselves at the end of a lesson. The concentration was too high in more than half of classrooms. This is quite alarming. Similar measurements taken in Sweden and Norway showed much better indoor air quality (lower CO_2 concentrations). The main reason for this was that most schools in Sweden and Norway have mechanical ventilation, while only half of Danish schools use such systems. These measurements were repeated in Denmark in 2014 and 2021. The results did not show any improvement.

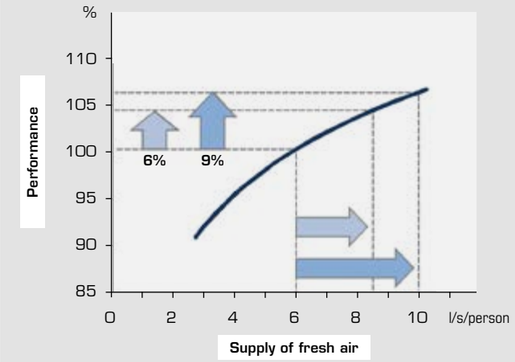
Ventilation principles.



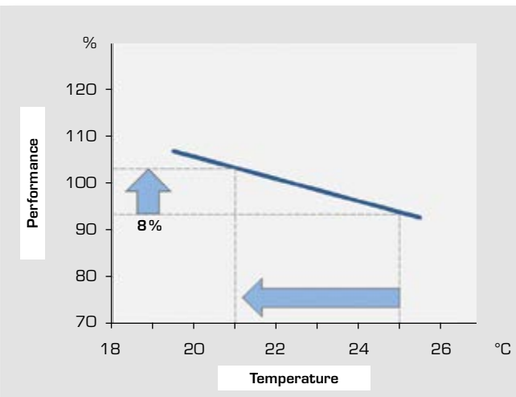
IAQ in Scandinavia 2009. Measurements in 1,000 schools in Denmark, Sweden and Norway.

Professor Geo Clausen has more than 30 years of experience working with international research cooperatives and working groups on the subject of indoor climate.

Mechanical ventilation and performance in the classroom.



Temperature and performance in the classroom.



Fresh air supply and temperature have a noticeable impact on the performance of students.

A study undertaken at a school in Vallensbæk near Copenhagen showed that the CO_2 concentration in the room air remained below 1,000 ppm thanks to energy-efficient ceiling ventilation that combines fresh air and good acoustics. In the improved indoor climate, the students completed 5% more test exercises and made half as many mistakes.

If we compare the two results, we can see that the performance of students improves by 10% when the air quality is good. 'When viewed across ten years of schooling, this corresponds to a whole year of extra learning,' stated Søren Terkelsen, who performed the measurements in Vallensbæk as part of his dissertation project at the Institute for Civil Engineering at the DTU.

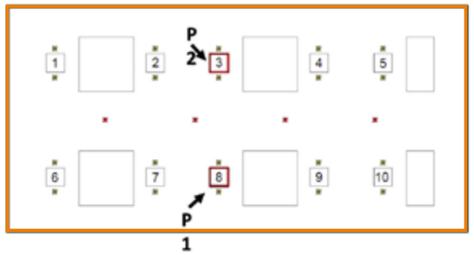
Source: Professor Geo Clausen, International Centre for Indoor Environment and Energy, Technical University of Denmark.

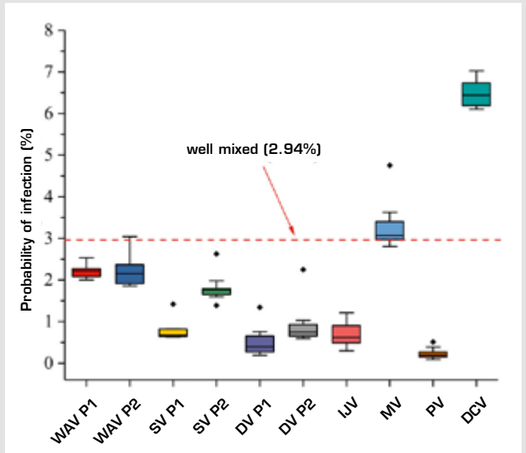
Reducing the risk of infection with mechanical ventilation.

Professor Geo Clausen's team examined various ventilation principles to determine the extent to which the risk of infection can be reduced. On average, the risk of infection drops to less than 3%.

Reducing airborne cross-infections indoors with targeted ventilation

Results





Probability of infection with different airflow principles.

WAV	Wall Attached Ventilation
SV	Stratum Ventilation
IJV	Impinging Jet Ventilation
PV	Personalized Ventilation
MV	Mixing Ventilation
DV	Displacement Ventilation
DCV	Diffuse Ceiling Ventilation

The economic effects of high-quality air in schools.

With more than 10,000 hours of school throughout an entire school career, Australia and Denmark have more than 50% more school hours than the OECD average – this is partly thanks to the progressive use of mechanical ventilation in educational institutions.

The economic impact of effective school ventilation is surprising. According to Professor Geo Clausen, the impact on the gross domestic product is approx. €173 million at a cost of just 25 cents per student per day. Thanks to increased productivity, there are fewer absences and fewer students repeating years. Denmark is allocating €36 million in the state budget to improve equipment.

Schools in Denmark.

Cost savings in Denmark.

Public budget (investments)	**€36 million**
Gross domestic product	
• Increased productivity:	€106 million
• Fewer students repeating years:	€67 million
	Total €173 million

Socio-economic effects of better air quality in Danish primary schools.

Annual increase in GDP:
€173 million

Annual improvement of public finances:
€36 million

Assumptions:
- Higher productivity as an adult
- Less likely to need to repeat the final year of school
- Fewer sick days for teachers

Source: Professor Geo Clausen, International Centre for Indoor Environment and Energy, Technical University of Denmark.

A conversation with Professor Geo Clausen.

Professor Geo Clausen, PhD Mechanical Engineer, Environmental and Resource Engineering Faculty, Technical University of Denmark, is a renowned expert on indoor air quality and its impact on health and performance.

PROFILE:

1977 – 1983	M. Sc. in Mechanical Engineering, Laboratory of Heating and Air Conditioning, Technical University of Denmark
1983 – 1986	Ph. D. in Mechanical Engineering, Laboratory of Heating and Air Conditioning, Technical University of Denmark
1986 – 1991	Research Associate (50 %), Technical University of Denmark; Technical Support Engineer (50 %), Brüel & Kjaer Inc.
1991 – present	Associate Professor, Technical University of Denmark

Professor Clausen, you started your research on the effects of poor indoor air quality on human well-being, health and performance more than three decades ago.

Yes, I did. I would like to give you a few examples. In a study* I conducted with esteemed colleagues in the 1990s, we compared the discomfort caused by indoor air pollution, heat exposure and noise under controlled conditions in climate chambers. In another study**, we investigated the influence of temperature and humidity on the perception of indoor air quality.

* G.H. Clausen, L. Carrick, P.O. Fanger, S.W. Kim, T. Poulsen, J.H. Rindel (1994): A comparative study of the discomfort caused by indoor air pollution, thermal exposure and noise. Indoor Air, vol. 4, p. 255 – 262.

** Fang, L., Clausen, G., Fanger, P.O. (1998): Influence of temperature and humidity on the perception of indoor air quality. Indoor Air, vol. 8, no. 2, p. 80 – 90.

At some point in your career, you started looking at indoor conditions in schools. What did you find?

We established that good indoor air quality has a positive effect on the students' well-being and performance. This should come as no surprise to you if you have ever experienced the stale and stuffy air in a classroom at the end of a school day. I have listed the most important results of the studies in the figure.

How important is mechanical ventilation during the COVID-19 pandemic?

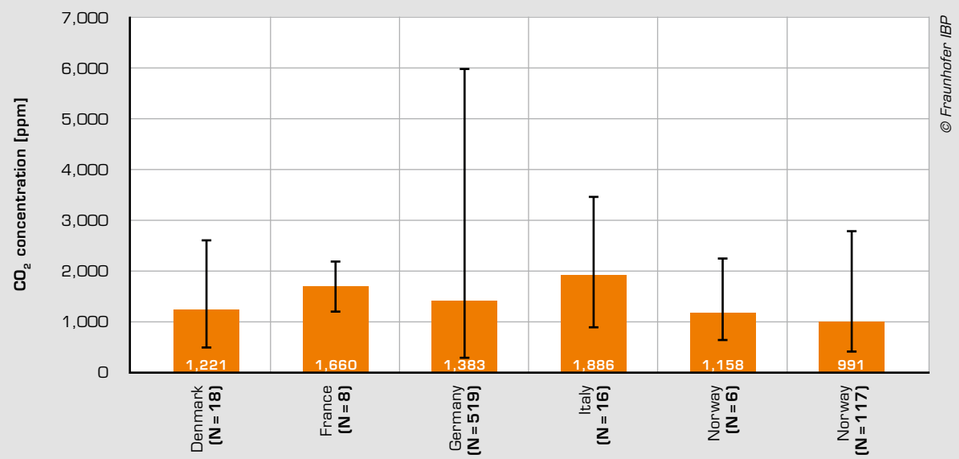
Exceptionally important. During the pandemic, the WHO discovered that the coronavirus could be transmitted through the air. This means that better ventilation reduces exposure to the virus and therefore the risk of becoming ill. Remember that in many European classrooms, excessive CO_2 concentrations are indicative of insufficient ventilation. With an investment cost of just 25 cents per student per day, we can protect the well-being and health of our students. Incidentally, this also has a positive economic outcome for society. Calculations have shown that the socio-economic impact of better air quality in Danish primary schools amounts to an annual increase in GDP of €173 million and an annual improvement in public finances of €36 million. All in all, there are many good reasons to keep concentrations below 1,000 ppm, which is the figure specified in Danish and many other regulations.

Do these results also apply to other types of building?

Definitely. For example, we know from numerous studies that good indoor air quality in offices improves the productivity and well-being of office workers. The impact on performance seems to be slightly less pronounced for school children. When you consider that the cost of good indoor air quality in offices is less than 1% of employees' salaries, the impact of a reduction in productivity of even just a few percent due to poor indoor air quality seems pretty significant. It simply pays to invest in good indoor air quality!

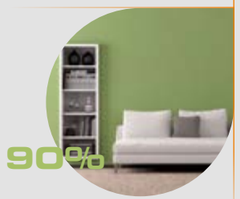
Professor Clausen, thank you for your time.

CO_2 concentration in schools in six European countries.



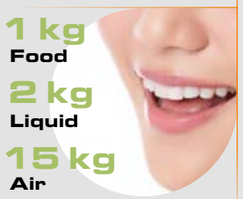
We have summarised the most important findings regarding good indoor air conditions in a new graphic.

Most people spend about 90% of their time indoors



Most people know that outdoor air pollution can affect their health, but indoor air pollution can also have significant and harmful effects on health.

Daily consumption per person

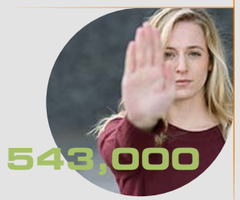


- Chemical substances
- Microbial pathogens
- Particles

Main sources of pollutants in the home and at work

- Outdoor air
- Residents and pets
- Cooking and heating
- Smoking (tobacco)
- Building materials
- Paint, floor and wall coverings
- Furnishings
- Cleaning products
- Pesticides
- Mould/fungus

The WHO warns that air pollution kills 543,000 young children every year



Harmful exposure can begin in the womb and continue when babies and young children breathe in polluted air.

Work performance

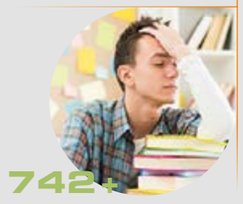
The reduction in work productivity due to poor air quality as a result of increased pollution / reduced ventilation is empirically estimated at 5%.

The cost of good indoor air quality in office buildings is less than 1% of staff costs.

An increase in work performance of 5% means:

- 25 minutes longer working days
- Fewer breaks
- 10 fewer sick days per year

Schools



More than half of the 742 classrooms examined in Denmark were inadequately ventilated.

Good indoor air quality is an important part of a healthy indoor environment and can help schools achieve their main goal: to educate children.

A 12% increase in learning performance is equivalent to one more year of education per child.

Advanced filtration can reduce exposure to pathogens by 42%

Outdoor air pollution contributes significantly to indoor air pollution. Over 90% of Europeans live in areas where the WHO guidelines on PM 2.5 are not met. Efficient filtration of outdoor air allows us to systematically control this particle-dominated component.

Investments that increase productivity are highly profitable

Personnel costs are:

- 25 to 100 times higher than energy costs
- 25 to 100 times higher than maintenance costs
- 4 to 15 times higher than rent costs
- 4 to 40 times higher than building costs

Source: Professor Geo Clausen, International Centre for Indoor Environment and Energy, Technical University of Denmark.

Professor Geo Clausen

The questionnaire was developed by Marcel Proust and popularised in Germany by the FAZ newspaper. We use it to ask quick-fire questions about people's likes and dislikes.

GETTING PERSONAL

Where would you most like to live?	In Denmark or in France.
What does real happiness mean to you?	Good health for everyone I know.
What kind of mistakes are you most likely to forgive?	Forgetting things.
Your favourite fictional heroes?	Ordinary people doing extraordinary things for others.
Your favourite historical figure?	No idea.
Your favourite composer, musician or band?	The Eagles or Mozart.
What's your favourite pastime?	Meeting with friends.
What's your favourite food?	Steaks!
Which qualities do you most value in friends?	Honesty.
What's your biggest weakness?	Impatience.
What would be the worst thing that could happen to you?	Being alone when I'm old.
What's your favourite colour?	Blue.
And your favourite flower?	Rose.
Your favourite animal?	Dog.
Your favourite book?	Savannah.
What motto do you live by?	Do the right thing!

TROX at Indoor-Air in Frankfurt.

High-quality, healthy air and a comfortable indoor climate were key topics for TROX at this trade fair, which took place from 5 to 7 October 2021.

One highlight was the launch of new scanning technology for existing buildings, which visitors were able to experience in person at the TROX stand. This technology provides BIM data that simplifies the work of architects, structural engineers and process planners. This technology also provides valuable data for the development of perfect air conditioning and ventilation solutions thanks to its precise three-dimensional mapping of rooms.

TROX offered its guests a glimpse behind the scenes at Messe Frankfurt. On exclusive tours, our experts demonstrated the functionality of TROX ventilation and smoke extraction technology installed in exhibition halls 11 and 12.

TROX had devised a rather unusual concept for its stand by setting up special meeting tables in Hall 12 that featured air curtains to provide a safe indoor air climate.

The Heinz Trox Foundation made it possible: Prof. Eckart von Hirschhausen spoke vividly and engagingly about the complex interrelationships surrounding air as a basic human necessity. Short expert interviews focusing on school and school ventilation rounded off the programme.

As well as showcasing intelligent – but perhaps more importantly – sustainable solutions for safe indoor air quality in public buildings, hotels, restaurants, schools or retail outlets, our experts also presented trendsetting system concepts, new strategies, and innovative digital and analogue technologies and products covering the full range of requirements for healthy indoor air.

Prof. Eckart von Hirschhausen
Physician, science journalist and founder of the 'Healthy Planet – Healthy People Foundation'

'Even though the benefits of air purifiers in schools are quite clear, they are still not being used in most schools. Where are they in the third year of the pandemic? Air is a basic human necessity, and it belongs to all of us. When we tell our children to go outside and get some fresh air, we should be able to count on the air being fresh. And when we talk about the "learning environment" in schools, the air should not make you ill, but rather facilitate healthy learning!'

On Air – a forum about the necessity of air.

The forum was organised by the German Association for Buildings and Indoor Air Quality (FGK – Fachverband GebäudeKlima e.V.) together with Messe Frankfurt. The groundbreaking impact of ventilation and air-conditioning technology – especially against the backdrop of the ongoing coronavirus pandemic – was addressed by expert panels and in panel discussions. The focus was on optimising health in buildings and the effects of stricter climate protection targets.

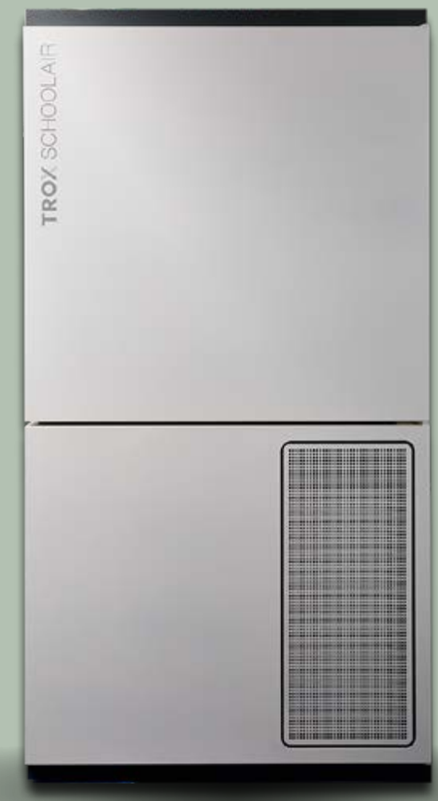
The three-day programme kicked off with 'Bad Air in Germany's Schools', hosted by Prof. Eckart von Hirschhausen. The subsequent panel discussion* was led by Prof. Hans Fleisch, chairman of the foundation council of the Heinz Trox Foundation.

Experts from industry, business, technology, science and medicine provided concise and clear information on clean air and reducing the risk of infection indoors. The focus was on ventilation and air purification requirements to reduce the risk of airborne infections and on fresh air supply and infection control, for example in schools.

Other topics covered included air purification units, their methods, operation and maintenance, air filtration systems and the sensible use of CO_2 control despite the pandemic.

The programme provided a succinct overview of current issues in infection control and types of air purification. Useful for all decision-makers, specialist consultants and users who are dealing with healthy air in indoor spaces.

* With Prof. Joachim Curtius, University of Frankfurt, Prof. Christoph Kaup, Chairman of FGK e. V., Prof. Dirk Müller, Institute for Energy Efficient Buildings and Indoor Climate, RWTH Aachen University, Prof. Uwe Franzke, German Institute of Air Handling and Refrigeration (Institut für Luft- und Kältetechnik gGmbH), The Association of German Engineers (VDI), and Sabrina Wetzel, Board of Directors of the German Federal Council of Parents (Bundeselternrat).



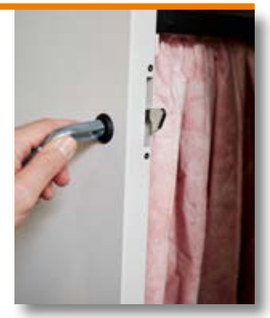
TROX SCHOOLAIR-S-HV

Floor-standing unit.

The new TROX SCHOOLAIR-S-HV floor-standing unit is the next logical step in the development and expansion of the decentralised ventilation unit product range that has been a success for many years.

Fast, draught-free room ventilation.

Easy-to-use control panel.



Simple filter change.

Aesthetically appealing and available in a wide range of colours, it can be seamlessly integrated into any interior design. It supplies the entire room with clean, filtered and perfectly temperature-controlled draught-free fresh air, which results in less CO_2.

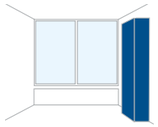
Flexible installation.

TROX SCHOOLAIR-S-HV can be placed on any wall in the room. This makes the ready-to-operate unit particularly suitable for use in classrooms, meeting rooms and group rooms in nurseries, schools and other educational institutions. Duct connections from wall or façade openings to the ventilation unit can be placed in the suspended ceiling. It can be installed in new buildings as well as conveniently retrofitted.

Moisture recovery for a healthy environment.

TROX SCHOOLAIR-S-HV uses a rotary heat exchanger for heat recovery. The heat energy is temporarily stored in the rotating storage mass and released again into the incoming airflow. As a result, the unit achieves an efficiency of 80%. In winter, moisture is recovered – an important factor in reducing infectious illnesses.

Fresh air and extract air filters with a service life of up to 12 months can be replaced without any tools.



What does Thorsten Dittrich, Head of Sales Germany, have to say about the new floor-standing unit:

‘After developing the air purifier, in addition to our range of excellent decentralised systems, we are now rounding off our portfolio with a completely new product.’

Outstanding performance.

- Nominal volume flow rate 800 m^3/h, boost mode 1,200 m^3/h
- Can be subsidised by the German Federal Office for Economic Affairs and Export Control (BAFA)
- Integrated CO_2 sensor to monitor indoor air quality
- Electric air heater integrated as standard
- Simple operation and demand-based control, optional control panel
- Connection to central building management systems with BACnet and Modbus
- Optional monitoring and control via X-TAIRMINAL or connection to the central building management system

New school ventilation sales team.

Healthy, performance-enhancing air in schools has become even more important around the world as a result of the coronavirus pandemic. The new school ventilation sales team is made up of specialists in customised, simple and highly efficient solutions from TROX.

It is now widely accepted that mechanical ventilation systems are superior to simply opening windows when it comes to creating a healthy learning environment in classrooms. The increase in concentration, performance and health due to a stable level of clean, fresh indoor air, which has been confirmed by many studies, has resulted in requests for customised ventilation solutions.

In addition to identifying the ideal ventilation concept, a perfectly dimensioned ventilation system that is easy to retrofit during refurbishments and the required air change rate, many other criteria play a role in keeping costs, construction work and time under control.

With the aim of consolidating expertise in the field of school ventilation, TROX has recently assembled the school ventilation team. This is a group of skilled specialists from in-house and external sales, quotation processing, order processing, product management, marketing, research and development, design, production, as well as colleagues from TROX HGI for service, who work together to find the optimum solution for every school.

The TROX school ventilation team
is up for the challenge.

The decentralised TROX school ventilation units are produced at the Neukirchen-Vluyn production facility in Germany.

The school ventilation consulting team: Bünyamin Simsek, Stanislaw Molleker, Marcel Leidenbach, Steffen Gräfe (not pictured) and project leader Klaus-Dieter Wolf (from the left).

The TROX school ventilation team.

If you have any questions or need advice on specific projects, please do not hesitate to contact the experienced members of the school ventilation team.

You can contact the
TROX school ventilation team via e-mail
schulluefung-de@troxgroup.com
or telephone
+49 2845 202–1111.

Quotes about school.

For millennia, famous and not so famous people have been musing about school. As early as 62 AD, Roman philosopher Lucius Annaeus Seneca made a critical statement about the school system: We learn not for life, but for school.

NON VITAE SED SCHOLAE DISCIMUS

Lucius Annaeus Seneca (approx. 4 BC in Corduba; † 65 AD near Rome)

For me, there are more important things in life than school.

Mark Twain

I had highs and lows at school. The highs were football.

Thomas Häßler

Do not worry about your difficulties in mathematics. I assure you that mine are greater.

Albert Einstein

An investment in knowledge pays the best interest.

Benjamin Franklin

I would rather have six hours at school than no sleep at all.

Words of wisdom from a student

Today I'm just nuts about the genitive.

Words of wisdom from a student

I feel as stupid, from all you've said, // As if a mill-wheel whirled in my head.

Johann Wolfgang von Goethe, Faust I

TROX® TECHNIK
The art of handling air

Published by:
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47504 Neukirchen-Vluyn, Germany
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Production:
TR advertising GmbH
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40545 Düsseldorf, Germany

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Associate editors:
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Printed by:
MD-Digital GmbH
Niederrheinallee 320
47506 Neukirchen-Vluyn,
Germany

Art director:
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Photo editors:
Alexandra Höver
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Image sources:
Cover/back page: Adobe Stock
P. 2/3: TROX GmbH
P. 4–7: iStock
P. 8–11: TROX GmbH, iStock
P. 12/13: iStock
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P. 66/67: TROX GmbH, iStock
P. 68/69: iStock
P. 70/71: Adobe Stock

Published in August 2022

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