Bad air out, good air in

To slow the spread of the SARS-CoV-2 virus, cleaning or exchanging the air is crucial, especially in enclosed spaces. As researchers at the Max Planck Institute for Dynamics and Self-Organization (MPIDS) in Göttingen have discovered, the risk of infection depends directly on the concentration of aerosol particles in the room that carry the virus. Ventilation systems that move fresh air indoors in enclosed spaces such as classrooms can help.

In view of the continuously rising number of infections and the simultaneous end of the summer vacations in many parts of Germany, the question arises as to what measures could be taken against a fourth wave of COVID-19 infections. There is widespread agreement in the political arena that renewed school closures should be prevented wherever possible. Window fans as ventilation alternatives could play an important role in reducing the risk of infection.

"If the air in the room is replaced with fresh air from the outside several times an hour, the risk of infection decreases considerably," says Professor Eberhard Bodenschatz, director at from MPIDS. "The advantage of technically supported air exchange with a window fan is that it always works, regardless of the weather."

"We have had very good experience with the system" says also veterinarian Alfred Mennekes, who paved the way for this solution. Measurements by MPIDS, Professor Hans-Martin Seipp of the Technical University of Central Hesse and Mennekes show excellent ventilation, which does not only provide clean air, but also ensures a very low carbon dioxide load.

Schools successfully test the new systems

A few weeks ago, the town of Legden in the Münsterland region decided to install the ventilation systems in the classrooms of their schools. Now the district town of Borken is following: A total of 144 systems are currently being installed in local schools. Particular attention is being paid to the elementary schools, as there is yet no comprehensive additional protection for the younger grades through vaccinations.

The decision was based not only on the effectiveness of the systems but also on the positive experience gained in neighboring Legden. There, Mennekes had already tested the fans in a pilot project together with the school management in spring. In contrast to mobile air filter systems, which clean and recirculate the ambient air, the fans are able to replace the entire room air several times an hour with fresh air from outside. In addition, unlike filter units, noise pollution is minimal during normal operation; the fan is virtually inaudible. And last but not least, the continuous supply of fresh air also ensures a constantly low carbon dioxide level in the classroom, which can have a generally positive effect on the learners' ability to concentrate.

The total costs of around 1,800 euros per installed ventilation system are borne by the city of Borken: The city had unanimously approved the installation, as it is a sensible investment in the educational infrastructure even beyond the
pandemic. The sustained supply of fresh air also improves the general indoor climate in the classrooms.

An efficient alternative to opening windows

The fan can run at outdoor temperatures of up to 10 Celsius without any significant heat loss, i.e. without the need for counter-heating. If it gets colder outside, the fan can be operated in shock ventilation mode: At intervals of 20 minutes, it then becomes somewhat noisy for about 3 minutes, after which the air is exchanged. Here, too, very little energy is lost; a heat exchanger is not necessary. In addition, this system eliminates the need to open the windows regularly, which can contribute to orderly school operations throughout the day.

All in all, therefore, the fans are an environmentally friendly and simple solution. Another advantage is that there are practically no further costs after the one-off purchase, as the fans are extremely low-maintenance. Likewise, the low energy costs of the systems are hardly noticeable in school operation.

In order to calculate how the probability of infection changes under given conditions such as room size, number of people or ventilation system, the MPIDS scientists have made their model available: With the HEADS-tool (aerosol.ds.mpg.de), the individual risk of infection can be calculated after entering the above parameters.
Exterior view of the ventilation systems, which are structurally integrated into the window front.