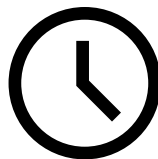


Air Purifiers, Fans, and Filters: A COVID-19 Explainer for Schools



By Mark Lieberman — October 27, 2020

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High school students take a physical education class at their school gym in Gifu, central Japan, on June 1, 2020. Air ventilation measures have been taken in schools all over the world to reduce the risk of coronavirus infection. Kyodo via AP Images

COVID-19 is surging in nearly every state, and public health experts are warning that colder temperatures and increased indoor activity will mean the virus is likely to remain an urgent threat for the foreseeable future.

At the same time, schools are grappling with the potentially devastating effects of learning loss, social isolation, and diminished access to vital offerings for millions of students who haven't been in a physical classroom since March.

Faced with limited resources and uncertain prospects for relief from the federal government, schools are in desperate need of clear, definitive guidance for reopening buildings safely and maintaining in-person instruction over the long haul. Some teachers in Boston have been posting pictures of their classrooms on social media and asking for guidance on whether their schools' mitigation efforts are sufficient. (Boston officials have since since closed school buildings due to a surge in COVID-19 cases.)

The role that air ventilation and filtration plays in slowing the spread of the virus is complex and has been confusing for educators to parse. Some schools have been scrambling to upgrade their HVAC systems and placing bulk orders for air purifying devices for classrooms. But questions remain about the effectiveness of these measures and the precise approaches that are most likely to succeed.

Education Week interviewed three experts on public health and air management, and a veteran school facilities director, about ventilation, filtration, air purifiers, and related mitigation measures. Here's what they recommend schools prioritize in the months ahead.

Why is clean air important for mitigating viral spread?

COVID-19 particles can live in the air for up to three hours. More ventilation (air movement) and better filtration (air cleaning) can cut down on the number of airborne particles that linger when an infected person coughs or exhales indoors. Airborne infection is 15 to 20 times more likely to occur indoors than outdoors.

What are the key elements for good air quality in a school building?

1. How much outside air gets into the building.

The more the better, says Mark Benden, director of the Ergonomics Center at the Texas A&M University School of Public Health. The ideal scenario would be a 72-degree day with windows fully open, which would mean the indoor air is essentially indistinguishable from the outdoor air.

2. How much air inside the building recirculates from one place to another.

"If the air is being pulled away from us very rapidly, greater than six times per hour, we don't have very much chance to breathe the same air," Benden said.

3. How often the indoor air gets filtered (cleaned) before being recirculated.

The faster the indoor air gets pushed through a strong filter, the less likely it will be that someone will breathe in viral particles from another infected person in the same room, Benden said. He recommends all schools have at least a MERV-13 filter in place in their mechanical filtration systems. Many schools have a

lower-strength filter, around a MERV-8 or 9. Benden likens the difference to an N-95 mask and a cloth mask—both are effective, but one is much stronger than the other.

The American Society of Heating, Refrigerating and Air-Conditioning Engineers also recommends schools use a MERV-13 filter or higher.

Keith Watkins, assistant director of facilities for the New Rochelle district in New York and current president of the National School Plant Management Association, has implemented MERV-15 filters in his district's school buildings. But some schools' mechanical systems can't support such strong filters, he said.

Why weren't these upgrades made before COVID-19?

A federal watchdog group found earlier this year that 41 percent of school districts needed to update or replace their air systems in at least half their schools.

Schools that have poor air quality tend to be hamstrung by costs, Benden said. They use cheap or outdated air systems that don't bring in much outside air or clean the indoor air as often as would be ideal.

"Since COVID, I think the blinders are off everyone," he said. "Everyone that has responsibility in this area is in touch with their groups and they're saying, 'We really need the best filters.'"

(For more on this topic, read Education Week's reporting from August on the wide variation in schools' HVAC capabilities.)

Does opening the windows help?

Yes. Opening windows even a couple inches "can really increase the number of air changes in the room" said Joseph Gardner Allen, a professor of public health at Harvard University.

He recommends schools keep windows open as much as they can even when the weather gets cold in some parts of the country. "Even if that means kids have to wear a heavier sweater, it's the simplest, most cost-effective strategy," he said.

Should schools put air purifiers in every classroom?

Experts agree that stronger filters for the school's existing ventilation system are a higher priority than individual air purifiers for each classroom.

"The things that I'm proposing, you probably should do for general better air quality anyway, for cold and flu," Benden said. "If you are going to buy something that you plugged into the wall, get a vaccine in the spring, then unplug it and throw it away, should you have bought that? No, probably not."

Allen believes portable air purifiers are only essential if a school is otherwise unable to improve its existing systems for a higher building-wide filtration rate. They should be used along with universal mask-wearing, social distancing, and frequent hand washing.

Watkins' district is not allowing air purifiers in classrooms—some are less effective than others, he said, and most are more effective in an average bedroom than an average classroom. “There were quite a few requests for them [from teachers] and they were all declined,” Watkins said.

However, many schools lack mechanical filtration systems that can withstand filters strong enough to adequately mitigate viral spread. That is why many have already been evaluating their air systems since COVID-19 shut down school buildings nationwide in March. Red flags to look out for include closed dampers, motors that have been turned off, and filters that were installed haphazardly or incorrectly.

“It’s akin to a tune-up for your car. The building needs a tune-up too,” Allen said.

In those cases, portable HEPA air purifiers are a worthwhile tool, he said.

A “HEPA” (high-efficiency particulate air) filter is most commonly found in the air systems of hospitals and airplanes. They “can theoretically remove at least 99.97% of dust, pollen, mold, bacteria, and any airborne particles with a size of 0.3 microns,” according to the Environmental Protection Agency.

How do I know which air purifier to get?

School districts should coordinate the purchases of purifiers for their buildings so they are uniform, rather than allowing a patchwork of different products. A unified strategy would cut down on the complexity of replacing filters across a school or district, and it will prevent purifiers that haven’t been properly vetted from entering buildings.

Allen helped build this online tool to help schools figure out which devices will be most effective. Important considerations include the size of the room, the number of people who will be in it, and the typical arrangement of people within the space.

Schools may need to consult a local engineer or commissioning agent (someone who oversees and advises on building design) to advise the best products for buildings, and the best placement for classrooms, said Corey Metzger, chair of the schools team for ASHRAE’s epidemic task force.

These decisions have high stakes: A poorly placed air purifier could inadvertently push air with infected particles from one part of the room to another. A loud filter that drowns out a teacher’s voice while operating at full strength could become less effective if it gets turned down to a lower setting. Some classrooms might benefit from two medium-strength filters rather than one that’s at full strength, Metzger said.

ASHRAE is working on a short document to help schools figure out their air purifier needs, Metzger said. In the meantime, the organization has developed detailed guidance for schools on air ventilation and filtration.

What about filters that have UV rays? Are those safe?

No, in fact, those devices might even be dangerous, Benden said. Some get hot quickly and could be fire hazards. Others emit odors or toxic gases like ozone that can be harmful to people at high volumes.

“What do we need? We need clean, breathable air. What do we not need? We need to not cause problems. We need to not run up the bill for electricity,” Benden said.

What about fans?

Small desk fans for a classroom likely wouldn't hurt, Benden said, but they won't make a meaningful difference for slowing the spread of COVID-19.

Larger fans placed near an open window could be useful for accelerating the spread of outdoor air in schools with no working HVAC system. But they could also blow viral particles away from the filters and create more spread than if they were turned off. Benden recommends avoiding them.

What do this fall's reopenings tell us about air quality priorities in schools?

Twelve percent of school districts are offering full-time in-person instruction, and another 65 percent are offering in-person instruction to some extent, according to a survey conducted earlier this month by the EdWeek Research Center. While there have been scattered reports of outbreaks, schools generally had not experienced significant COVID-19 spread in their buildings through mid-October. To Benden, that's an encouraging sign that schools are taking ventilation, filtration, and other precautions seriously.

“We can dial up our current systems to really optimize, and we can do that with what we've got,” Benden said. “It's working.” (Read this Education Week article for more on in-person instruction during COVID-19.)

A national database of school building reopenings, focused on drawing lessons from success stories, would be useful as more schools aim to reopen in the next couple months, Allen said. Similarly, states can do more to help—the Arizona state agency required to inspect school buildings' ventilation systems, for instance, hasn't conducted reviews of school buildings this year, the Arizona Republic reported this month.

Watkins has installed air particulate meters that can provide data on particles on surfaces and in the air. His district plans to use those numbers to inform future decisions on upgrading air systems, he said.

I am a teacher. Who can I ask to learn more about my school building?

In many cases, school and district facilities managers will have detailed information about ventilation and air filtration. Some can even change settings on fans and filters in the school's air infrastructure remotely from their computers, Benden said.

Are air purifiers in short supply?

Several schools in Massachusetts and Rhode Island delayed the start of in-person instruction after air purifier shipments hadn't arrived due to supply chain issues. Those delays are likely to persist as demand for these devices continues.

Allen lamented that many schools have had to turn to searching for guidance on the internet and making individual purchases because the federal government hasn't provided a nationally coordinated strategic plan for ensuring buildings are safe and ready for students and teachers to enter.

Will all this investment in improving air systems pay off in the long run?

Almost certainly. The same systems that filter out COVID-19 particles are simultaneously removing allergens, dust mites, skin flakes, and other particles that can trigger allergies and asthma in many students. One study in Los Angeles prior to the pandemic found improving schools' air quality could lead to better test scores for students.

The District of Columbia's public school system has spent \$24 million on HVAC upgrades in preparation for school buildings to partially reopen next month. Watkins said upgrading air systems in his district cost around \$250,000, but in a smaller district, the price tag could be as low as \$35,000. His association, which has facilities directors from schools in 22 states, has been an invaluable resource during a time when many long-established protocols have to be rethought.

"After 30 years, I feel like my career has started all over again," he said.



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