



# A HEALTHIER FUTURE STARTS INDOORS: K-12 SCHOOLS

As knowledge and awareness of infectious disease continues to increase across the world, educators, administrators and parents are more focused than ever on ensuring healthy indoor environments in the places our children learn and grow. With an evidence-based approach and the right healthy buildings strategies, we can not only help keep students safe and healthy – we can turn schools into even more powerful tools for their progress and performance.

## KEY PRIORITIES



## THE SCIENCE OF HEALTHY SCHOOLS

While much of the effort to create healthy indoor environments in schools is focused on reducing the spread of disease, research has shown the potential benefits to be even greater.



### STUDENT HEALTH

#### VENTILATION & HEALTH



The number of upper respiratory symptoms and high rates of missed school days were significantly associated with inadequate ventilation and dampness or moisture damage in a study of 4,248 sixth grade students from 297 schools.

(Toyinbo et al, 2016)



### STUDENT THINKING

#### VENTILATION & THINKING



Students' attention processes are significantly slower in classrooms with high CO<sub>2</sub> levels and low ventilation rates.



Researchers observed a **5% decrement in "power of attention"** in poorly ventilated classrooms, roughly equivalent to the impact that a student might feel from skipping breakfast.

(Coley et al, 2007)

#### THERMAL HEALTH & THINKING



In university students (n=56), complex tasks such as working memory, reasoning and planning skills appear particularly **vulnerable to heat stress (75° F to 82° F)**

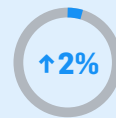
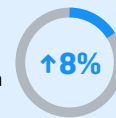
(Zhang & Dear, 2017)



### STUDENT PERFORMANCE

#### VENTILATION & PERFORMANCE

Students in classrooms that received portable mechanical ventilation systems interventions performed faster and more accurately on computerized tasks.



(Bakó-Biró et al, 2011)



In a study of 70 elementary schools, 140 fifth grade classrooms and 3,109 students, math test scores **increased by 11 points per liter per second of additional ventilation** (in range of 0.9-7.1 liters per second per person)

**Additional 12-13 points per each 1° C decrease in temperature** (in range of 20-25° C)

(Haverinen-Shaughnessy et al, 2015)



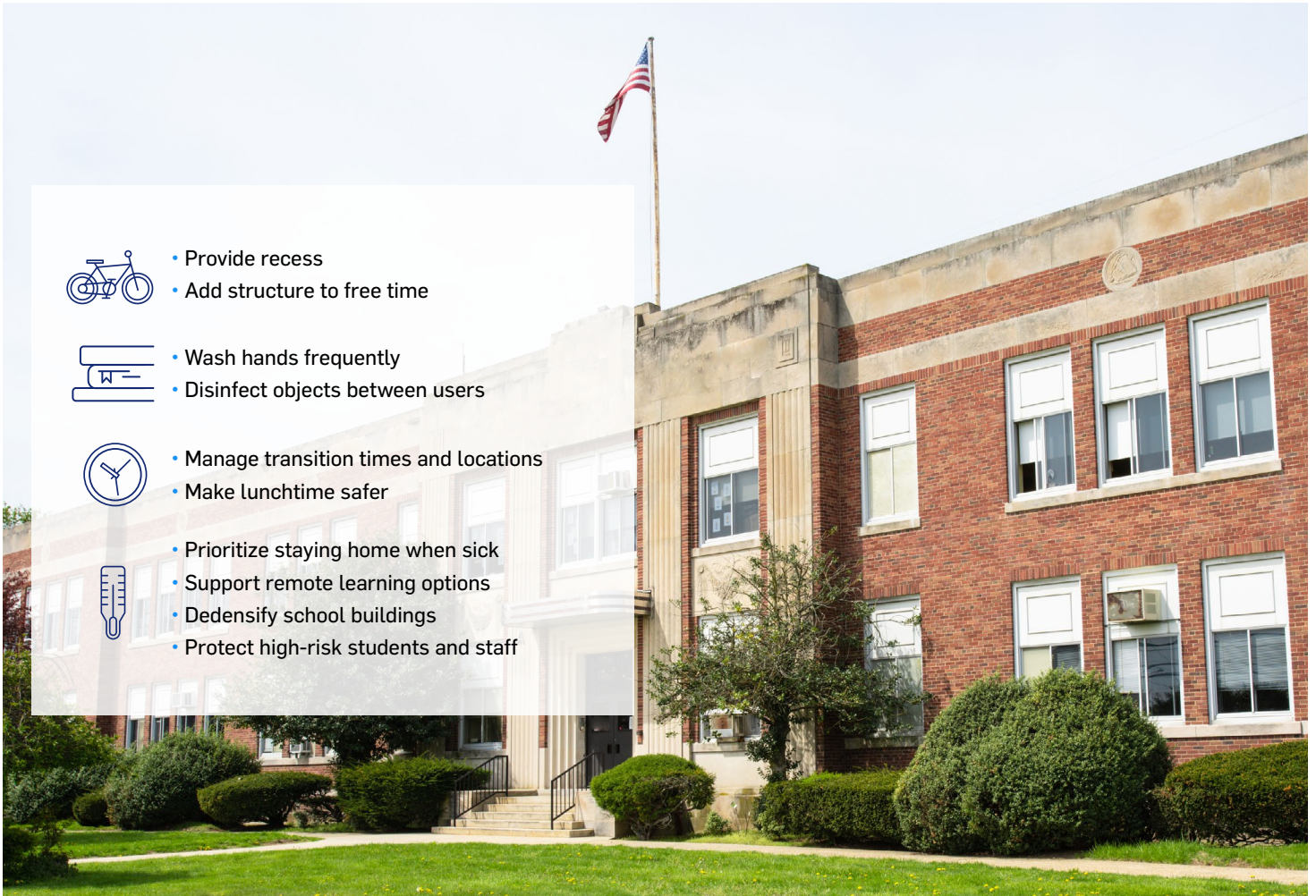
**For every 1° F increase, test scores fell by 0.2%**

Taking an exam on a 90° F day versus a 75° F day would have a **12.3% higher likelihood of failing** (equivalent to the Black-white achievement gap)

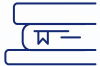
(Park, 2016)

## HEALTHY SCHOOLS IN ACTION

K-12 school operators can take a number of actions to improve indoor air quality, reduce the spread of infection and transform any school into a healthy school.



- Provide recess
- Add structure to free time



- Wash hands frequently
- Disinfect objects between users



- Manage transition times and locations
- Make lunchtime safer



- Prioritize staying home when sick
- Support remote learning options
- Dedensify school buildings
- Protect high-risk students and staff

## HEALTHY BUILDINGS ASSESSMENTS FOR SCHOOLS

At Carrier, we understand that many schools and districts might not know where to start when it comes to developing a healthy building strategy. Retrofits, modernizations and upgrades must be done with student health and safety as a top priority, while being smart about costs, budgets and future requirements. Our experts are here to help – starting with assessments across various aspects of a building.



**INDOOR AIR QUALITY**  
**THERMAL COMFORT**  
**OCCUPANCY FLOW**  
**BUILDING MAINTENANCE**  
**REGULAR HOUSEKEEPING**  
**ENERGY EFFICIENCY**

## CARRIER HEALTHY BUILDINGS PROGRAM

As the inventors of modern air conditioning and a world leader in HVAC and refrigeration solutions, Carrier has a legacy of creating safe and comfortable buildings. Now we're building on that legacy through our Healthy Buildings Program. Our experts have in-depth knowledge and experience in K-12 education and a holistic suite of healthy building technologies and services to help meet the needs of the industry today and long into the future.



**HEALTHY BUILDINGS SOLUTIONS FOR SCHOOLS**

Carrier offers a full suite of products and services designed to help create safe and healthy environments for students and educators. The following are just a few highlights of our offering.

**AIRSIDE TECHNOLOGIES**



RMAP AIR PURIFIER



ACTIVAIR™ HYBRID HYDRONIC AIR TERMINAL



AGION®-COATED AIR-HANDLING UNIT

**GET STARTED WITH AN EXPERT**

From keeping students as safe as possible, to helping them perform their best, a healthier future starts indoors. Let's work together to unlock the enormous potential of healthy schools. Visit us at [carrier.com/healthybuildings](https://carrier.com/healthybuildings) to learn more about our Healthy Buildings Program and connect with one of our experts.



**HEALTHYBUILDINGS**