When the heat is on, student learning suffers

May 30 2018

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Heat waves are taking their toll on schoolchildren, particularly those from low-income families and minority groups. That is one takeaway from a new research study examining the impact of cumulative heat exposure on cognitive skill development, co-authored by Harvard Kennedy School Associate Professor Joshua Goodman.

Hotter countries tend to be poorer. Hotter countries also tend to score lower on academic achievement measurements. Goodman and his fellow researchers examined the test scores of millions of American high school students to determine whether heat had an impact on their academic achievement.

The findings were clear: students scored lower when they had just experienced a hot school year than when they had just experience a cool school year; low-income and minority students were impacted by heat more than others; and air conditioning in schools all but completely eliminated the impact of heat.

"We show that only school-day exposure to higher temperatures affects test scores; hot summers and weekends have little impact on achievement and controlling for such exposure does not shrink the magnitude of impact of hot school days," the authors write. "This suggests that heat's disruption of instruction or homework time is responsible for the observed drop in test scores."

The drop in performance is significant, the research showed. On average, student achievement fell by the equivalent of 1 percent of a year's worth of learning for each additional degree Fahrenheit in temperature during the year preceding the exam.

The impacts are exacerbated for low-income students and those from minority groups. "For students living in zip codes in the lowest quintile of average income, a one degree Fahrenheit hotter prior school year is three times as damaging to academic achievement as it is for those living in the highest quintile of income," the authors report. "Similarly, the impact of heat on achievement is three times as large for black and Hispanic students as for white students."

But having air conditioning in classrooms changes everything, the

research showed, offsetting nearly all of the damaging impacts of cumulative heat exposure on student achievement. "School air conditioning penetration reported in 2016 mitigates the adverse effect of hot temperatures substantially, such that moving from a school with no air-conditioned classrooms to a school with all air-conditioned classrooms reduces the impact by approximately 78 percent," they write.

Goodman and his fellow researchers state that their study could influence thinking around achievement gaps, the impact of global climate change, and the benefits of keeping classrooms cool.

"We argue that heat effects account for up to 13 percent of the U.S. racial achievement gap, both because black and Hispanic students live in hotter places than white students and because heat damages minority students' achievement more than white students' achievement," they write. "We estimate that school air conditioning would offset over $25,000 per classroom per year in future lost earnings due to temperature increases predicted by climate change models. The… benefits appear substantially larger than the costs of installing and operating such infrastructure."

The study was based on data from 10 million American students from the high school classes of 2001 to 2014 who took the PSAT exam multiple times.

More information: Heat and Learning. NBER Working Paper Series. scholar.harvard.edu/files/josh … man/files/w24639.pdf

Provided by Harvard Kennedy School

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