UCLA Luskin Center for Innovation

Unequal Learning in a Warming World

Heat reduces student learning, and low-income and minority students are affected disproportionally

As kids get ready to head back to school, a forthcoming paper in the *American Economic Journal: Economic Policy* finds that a lack of air conditioning in the classroom contributes to racial achievement gaps, and that expanding air conditioning to more schools could help narrow that gap. Building on previous research on the effects of excessive heat on academic achievement, *Heat and Learning* is the first peer-reviewed paper to put dollar figures on the costs and social benefits of widespread air conditioning in schools.

To help journalists tell the story, *Heat and Learning's* key findings and other relevant data are presented below. For further information or to set up an interview with lead author R. Jisung Park of UCLA's Luskin Center for Innovation, please contact Carina Daniels at carina@storyandreach.com or 510-847-1617.

KEY FINDINGS

Lack of school air conditioning contributes to the achievement gap in education, and climate change could exacerbate this gap

- Up to 7% of the racial achievement gap (between black and Hispanic students on one hand and white students on the other) can be explained by the combined influence of unequal school facilities and where students live.
    - Black and Hispanic students overwhelmingly reside in hotter locations than white students.
    - Findings suggest that a cumulative increase in school-year temperature appears to have an 80% larger impact on black and Hispanic students than on white students.
- Equalizing rates of school air conditioning could reduce the racial achievement gap by 25% of the combined gains that other types of educational investments have achieved over the past four decades.
- Without further investments in school infrastructure, climate change will likely result in a further widening of current racial achievement gaps.

Low-income and minority students have less access to adequate air conditioning

- Nearly 40% of US schools may not be fully air conditioned.
- Although Black and Hispanic students overwhelmingly reside in hotter locations than white students, they are 9% less likely than white students to have school air conditioning.
- Lower income (below median neighborhood income) students are 6% more likely to report having inadequate school air conditioning.

- Black and Hispanic households are 6% and 7% less likely, respectively, to report having air conditioning at home for any given climate and income group.

The paper shows that widespread school air conditioning can be a cost-effective method of narrowing the achievement gap

- For the average American school, the cost of improving scores by one percent of a standard deviation using air conditioning is estimated to be **between $25 and $125 per student per year.**
- For comparison: the average cost of improving scores by one percent of a standard deviation as part of the benchmark Tennessee STAR experiment, which reduced class sizes by roughly one third, is estimated at **$163 per student per year.**
- Based on existing research into later-life monetized impacts of improved learning in secondary school, in hot areas such as Houston or Atlanta, the monetized future impact of student learning could be as much as $2 million per year for each 1000- student high school (roughly $50,000 per year per 25-student classroom).

ADDITIONAL FINDINGS

Heat reduces student learning and performance

- Without air conditioning, a 1°F hotter school year reduces student learning by 1%.
- A sustained increase in temperature of 3.6°F (2°C) reduces an average year's worth of learning by 7%.
- The cumulative effect of elevated temperature over multiple school years is substantially larger than the effect of elevated temperatures over a single school year.

Air conditioning may mitigate the problem

- For the average student, school air-conditioning appears to offset 73 percent of the learning impact of hot school days, or 0.0025 standard deviations in learning damage for each 1°F increase in temperature.
- This translates to air conditioning providing an estimated present value of $212 in recovered future earnings per student, for every 1°F increase in temperature during a given school year.

Global warming will affect this calculation

- Two degrees Celsius of global warming is projected to lead to a roughly 10% reduction in the amount of learning achieved each year, if additional infrastructure investments are not made.

ADDITIONAL CONTEXT

Policymakers and school districts are beginning to take action

- In 2017, New York City dedicated $28.75 million to purchase and install air conditioning units in all classrooms over a five-year period.

    - Data from New York City public schools, collected before this air-conditioning initiative began, showed students who take a high school exit exam on a 90°F day have a 7% higher likelihood of failing a subject; this pushes some students to drop out prematurely (Park 2017).
- Chicago-area schools are making air conditioning upgrades funded by a $24 million Qualified School Construction Bond.
- The Los Angeles Unified School District has spent more than $20 billion to build and upgrade school facilities — including upgrading air conditioning — with equity concerns playing a major role. Replacement of outdated HVAC systems continues.

Global warming trends continue

- July 2019 was the hottest month on record for the planet, according to NOAA.
- June 2019 was the hottest June on record, according to NOAA.
- The first six months of 2019 tied with 2017 as the second hottest on record.