

Low-income kids use different brain function to ace achievement tests

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A common stereotype is that growing up poor can stunt brain development due to adverse environmental conditions. But on a positive note, new UC Berkeley research suggests that children's brains can adapt

in different ways to socioeconomic challenges and excel.

The study, to be published today, Dec. 10, in the journal *Nature Communications*, compared the brain scans of more than 6,000 U.S. [children](#) from families across the socioeconomic spectrum.

It found that a link between brain activity and [high scores](#) on achievement tests that measure reasoning, attention and flexibility, among other mental functions, occurs more in affluent children than in their lower-income peers.

Conversely, the study found a different pattern of [brain activity](#) in low-income children who performed well in [achievement tests](#), which suggests that previous studies have depended on more well-to-do participants and do not represent people of all socioeconomic backgrounds.

"Our results fly in the face of a number of prior studies, as they show that a pattern of brain network connectivity that has been associated with strong test performance in both adults and children does not generalize to children below the [poverty line](#)," said study senior author Silvia Bunge, a UC Berkeley professor of neuroscience.

"If anything, we found the opposite brain-behavior relationship for children in poverty, and this is particularly the case for those who were the most disadvantaged with regard to schooling, living circumstances, race and ethnicity," she added.

The results underscore the need to refrain from taking a one-size-fits-all approach to the study of brain development, the researchers said.

"A lot of research suggests that children growing up in poverty tend to do worse academically. But, many of them are doing as well, if not

better, than their higher-income peers," said study lead author Monica Ellwood-Lowe, a Ph.D. student in psychology at UC Berkeley.

Brains not broken, but adaptive

Ellwood-Lowe and Bunge sought to understand how the brains of children from different socioeconomic backgrounds develop to meet academic and cognitive challenges.

"We wanted to find out what was happening for these high-performing kids in poverty, based on their patterns of brain development," Ellwood-Lowe said. "In other words, we wanted to see what was going right, instead of going in looking for what could be going wrong."

To gauge that, they used brain imaging data from the Adolescent Brain Cognitive Development (ABCD) study, the largest national longitudinal study of child and teen brain development. They analyzed thousands of [brain scans](#) of U.S. children ages nine to 11 who came from households earning both above and below the federal poverty level of \$25,000–\$35,000 a year.

Specifically, they looked at connectivity between the brain's lateral frontoparietal network, which is crucial for performing challenging cognitive tasks, and the default mode network, which is active when the mind is wandering, rather than focused on a particular task at hand.

Affluent children with [higher test scores](#) showed less connectivity between these two neural networks, and those with lower test scores showed stronger connectivity. The reverse was true for low-income kids.

"Overall, our findings suggest that the brains of children living in poverty might develop differently, but not less effectively, because they're up against different constraints in their home and school

environments," Ellwood-Lowe said.

The results underscore the developing brain's plasticity, and the ability of children to find neural workarounds to compete academically, regardless of socioeconomic challenges that may rewire their brains.

Moreover, they shed new light on the achievement gap in schools and question presumptions about the kinds of environments that foster high academic performance.

"Most studies of brain [development](#) rely on samples of children who come from highly educated and relatively wealthy families" Ellwood-Lowe said. "But our study finds that this has limited our knowledge about the scope of healthy [brain development](#)."

The researchers plan to use these results to further explore the [brain](#) networks and behavior that can boost achievement in low-income children and adolescents.

More information: Monica E. Ellwood-Lowe et al, Brain network coupling associated with cognitive performance varies as a function of a child's environment in the ABCD study, *Nature Communications* (2021). [DOI: 10.1038/s41467-021-27336-y](https://doi.org/10.1038/s41467-021-27336-y)

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