

MindPrint Research Brief

Post Pandemic Brain Changes: Results from 35K Students

The Reason Students (and Teachers) Aren't Fully Recovered from the Pandemic

By Dr. Nancy Tsai

Certain results from this study were generated using the Web-Based Computerized Neurocognitive Battery licensed from the University of Pennsylvania. Statistical findings are specific to this population. However, given these results are consistent with other studies with different populations, there is a higher probability that these findings would generalize to broader populations and contexts.



MindPrint
learning

Summary

A recent cross-sectional study including 35k students' pre and post pandemic highlights the following brain-based changes (Tsai et al., in prep):

- **Students across all age and SES groups showed declines in all facets of cognitive skills (complex reasoning, memory, and executive functions).**
 - **Greater declines in verbal reasoning** may likely contribute to lower than expected reading and language outcomes.
 - **Greater declines in flexible thinking** may likely contribute to lower than expected academic performance and also underlie challenging behaviors.
 - **Greater declines in memory skills** (verbal and visual memory) may likely contribute to the declines in STEM, given the cumulative nature of learning in this area.
- **Students of different age and SES groups were differentially impacted.**
 - **Younger students** (those in elementary school during covid) showed greater declines in verbal memory, relative to their middle and high school peers.
 - **Lower SES students** also showed greater declines in verbal memory, relative to their middle- and high-income peers.
- **Adults also show declines in cognitive skills with greater declines in memory.** Similar cognitive challenges with adults could explain the higher reported levels of teacher dissatisfaction and low morale.

Discussion

The study examined changes in cognitive skills (complex reasoning, memory, executive functions) and showed significant declines in nearly all areas relative to student performance before the pandemic. Cognitive skills are highly correlated to and predictive of academic achievement. The findings also revealed that younger students were disproportionately impacted: That is, larger declines in cognitive skills were found in younger students. This is consistent with recent studies on the larger academic declines in younger students in both math and reading. These changes in students' cognitive skills over the course of the pandemic align with prior research highlighting the impact of chronic stress on brain development and function.

Another key trend surfaced from the findings: learners from lower income communities showed greater declines in cognitive skills, particularly in verbal reasoning. These findings are also consistent with reported differences in post-pandemic achievement in the classroom as well as the broader body of scientific

literature identifying the numerous links between socio-economic status and achievement gaps.

Reports of imperiled mental health and academic achievement in youth have flooded popular media since the start of Covid-19, but the underlying causes have remained elusive until now. This original research is the first to identify the brain mechanisms that may explain the changes seen in youth outcomes in and outside the classroom since the pandemic. Changes in core cognitive skills and notably, weaker cognitive skills, may be the explanatory link. More importantly, these findings capture neuroplasticity, the malleability of cognitive functions in different contexts (e.g., chronic stress), and offer a data-driven means of identifying targeted interventions to address academic challenges.

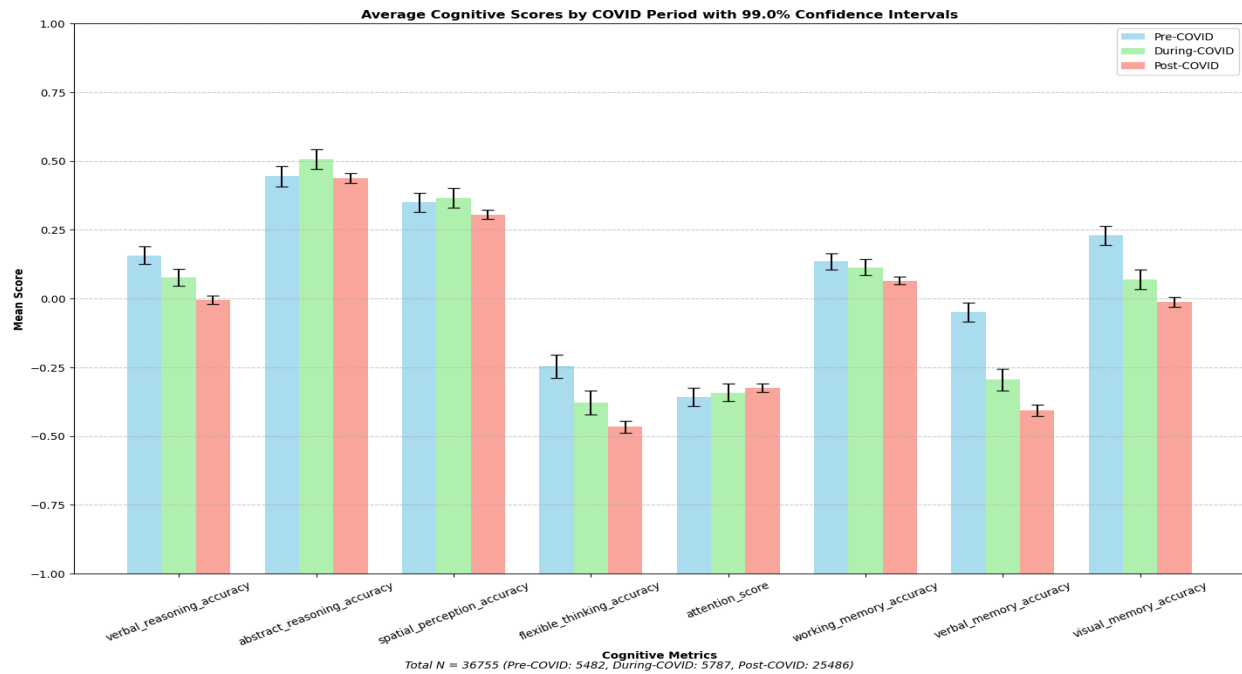
Given the size of the participant sample ($n > 35,000$) and the diverse age, socio-economic, and geographic distribution represented, there is a higher probability that these findings would generalize to broader populations and contexts. However, the cross-sectional nature of the study limits our ability to draw causal claims.

Figures

Comparing the means for cognitive skills pre, during and post pandemic with a 99% confidence interval. Given the data, there is a 99% chance that the actual population mean for each metric lies between the upper and lower bounds, providing high confidence in the range in the mean values presented. The COVID period was treated as March 2020 through July 2021. The data includes students ages 8 to 18.

Pre and Post Covid Changes in Cognitive Skills (All Ages and Income)

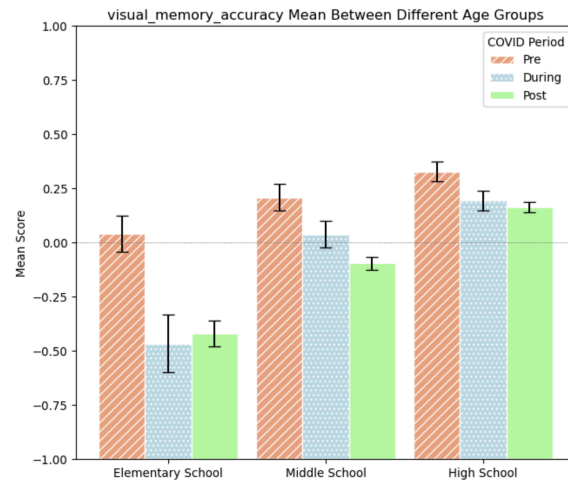
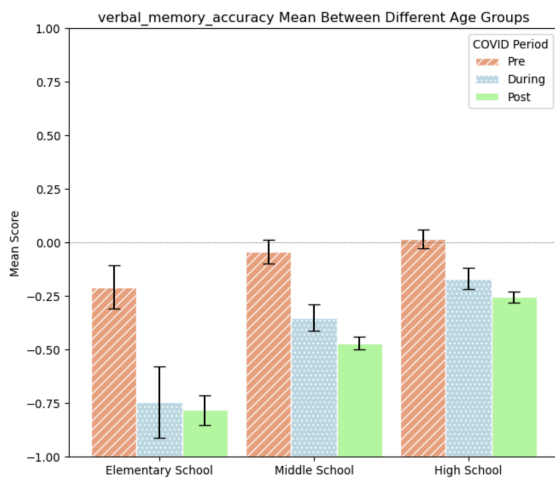
Students showed post-pandemic declines on many cognitive skills. The most significant declines were in Verbal Reasoning, Flexible Thinking, Verbal Memory, and Visual Memory.



Note. Changes comparing Pre vs. Post Covid time points all significantly differed for: Verbal Reasoning, Spatial Perception, Flexible Thinking, Working Memory, Verbal Memory, and Visual Memory. Verbal and Visual Memory show the greatest level of change as measured by effect sizes (Cohen’s d).

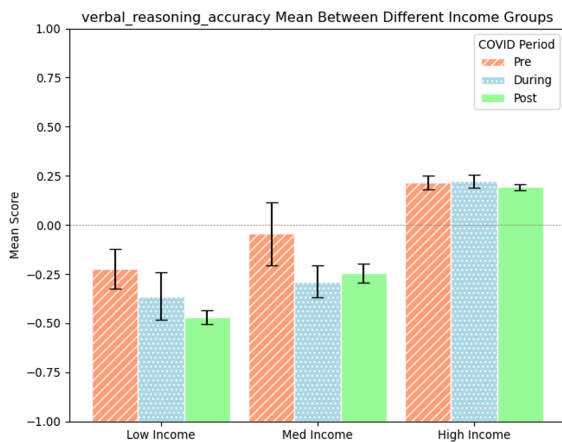
Pre and Post Covid Changes in Memory by Age

While students across all age groups showed significant declines in memory, the decline was much larger in younger students. These results are consistent with the larger declines in academic achievement scores reported in younger students.

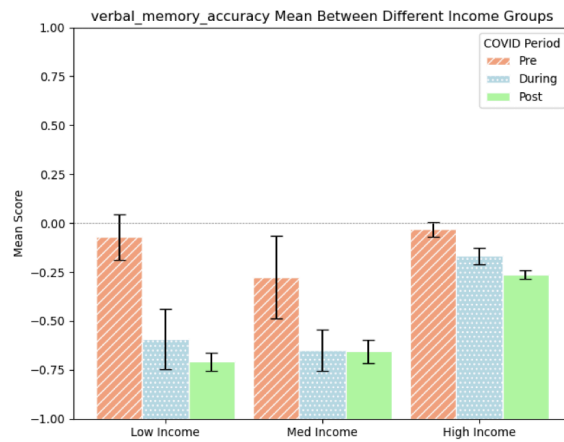


Pre and Post Covid Changes in Verbal Skills by Income

Lower income students did show larger declines in skills than higher income peers. This was most notable in verbal scores which are highly correlated with academic achievement in all subjects.



Total N = 36755 (Pre-COVID: 5482, During-COVID: 5787, Post-COVID: 25486)

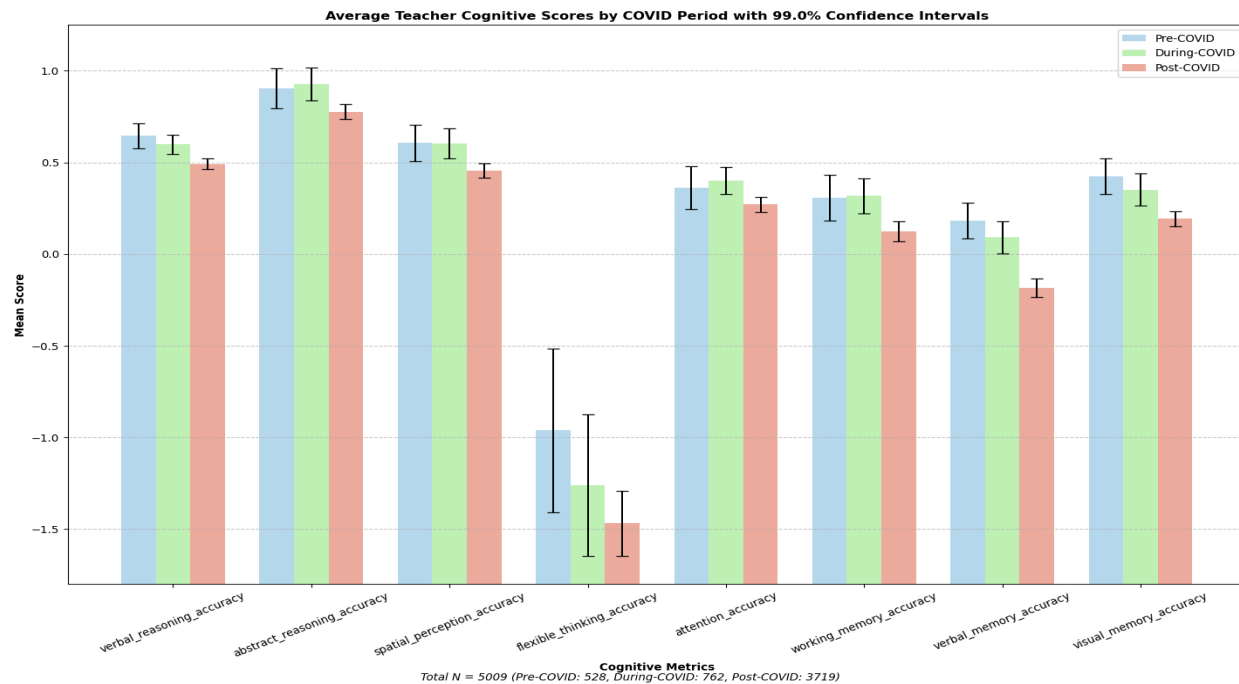


Total N = 36755 (Pre-COVID: 5482, During-COVID: 5787, Post-COVID: 25486)

Pre and Post Covid Changes in Educators

Educators showed similar trends as students, albeit they started at an overall higher average score on most skills. Similar to students, the largest declines were in memory, verbal reasoning, and most consistently when comparing pre-covid and

post-covid time points (e.g., the difference in flexible thinking pre- vs. post-covid is statistically significant).



Note. Changes comparing Pre vs. Post Covid time points all significantly differed for: Verbal Reasoning, Abstract Reasoning, Spatial Perception, Flexible Thinking, Working Memory, Verbal Memory, and Visual Memory. Verbal and Visual Memory show the greatest level of change as measured by effect sizes (Cohen's d).



About the Author

Dr. Nancy Tsai is an expert in applied Cognitive Neuroscience where she examines the link between executive functions and human well-being. She completed her scholarly training at U.C. Berkeley, Harvard University, U.C. Irvine, and is currently a research fellow at MIT and instructional faculty member at Harvard College. Nancy has won numerous awards for her scientific work, including funding from the National Science Foundation. Her original research is published in *Journal of Neuroscience*, *Brain & Cognition*, *Journal of Applied Research in Memory and Cognition*, among other top peer-reviewed journals.