The Impact of Sustained Cognitive Effort on Student Performance in India

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Sector(s): Education, Health

Fieldwork: Behavioral Development Lab (BDL)

Sample: 1,636 primary school students across six primary schools

Target group: Children Students

Outcome of interest: Student learning Cognitive development

Intervention type: Early childhood education Pedagogical innovation

AEA RCT registration number: AEARCTR-0002673

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Research Papers: Cognitive Endurance as Human Capital

Partner organization(s): USAID Development Innovation Ventures, University of Pennsylvania Global Engagement Fund, Weiss Family Program Fund for Research in Development Economics

Schooling can have a large impact on students by increasing their academic skills and influencing their cognitive development. In particular, schooling may affect students' "cognitive endurance," or the capacity to remain focused on a cognitively challenging task over time. Cognitive endurance may, in turn, impact students' performance at school. Researchers conducted a randomized evaluation to test the impact of practicing sustained cognitive activity on cognitive endurance and school performance in Lucknow, India. Students that spent additional time engaging in sustained cognitive effort received higher grades in all of their classes, improved their performance on tests, and appeared more attentive in the classroom.

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Schooling can have a large impact on students by increasing their academic skills and influencing their cognitive development. In particular, schooling may affect students' "cognitive endurance," or the capacity to remain focused on a cognitively challenging task over time. By increasing students' focus over long periods of time, greater cognitive endurance could improve a student's capacity to be attentive during class, maintain focus while reading or doing homework, or correctly answer the last questions of an exam. While cognitive endurance may be affected by a student's educational environment, it is uncertain how various schooling approaches can influence the development of cognitive endurance. How does schooling impact students' capacity for sustained cognitive effort over time?

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In Lucknow, India, low-income primary schools provide limited opportunities to practice sustained cognitive activity. Teachers usually use rote memorization as their primary learning technique in class, which is common among many low- and middle-income countries. Further, classrooms are crowded, and frequent classroom disruptions and noise may hamper students' focus while completing schoolwork. As half of the students in a classroom may be under grade level, they are often unable to attempt independent assignments, and end up disrupting other students instead. Moreover, students often spend little time on homework or other cognitively challenging tasks outside of school, which further decreases their opportunities to develop cognitive endurance.

Research shows that student performance tends to decline over the course of a test at a higher rate for low-income students than for high-income students. As high-income students might receive more time during the school day to focus on independent academic activities, this could potentially improve their cognitive endurance. In this study, researchers assessed students in six private primary schools from rural and urban areas that served predominantly low-income households.



School children read in India.

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Researchers conducted a randomized evaluation to test the impact of sustained cognitive activity on school performance and cognitive endurance in Lucknow, India. Researchers randomly assigned 1,628 students in grades 1–5 to one of three groups:

1. *Math practice group* (548 students): Students spent twenty minutes independently solving math problems on a tablet, using the imagine Math app. While the app did not provide any math instruction or correspond to the students' school

curriculum, it adjusted the difficulty of problems to match each student's skill level.

2. *Games practice group* (543 students): Students spent twenty minutes playing cognitive, non-academic games (such as mazes or tangrams) on a tablet. Researchers chose non-academic games that included no sound, text, or numbers, also adjusted in difficulty to match each student's skill level.
3. *Study Hall group* (537 students): In this comparison group, students spent twenty minutes in a math study hall, in which the teacher wrote five grade-level math problems on a chalkboard, before sitting down and letting the students decide whether to attempt the problems.

While all sessions lasted the same amount of time, students in all groups were free to decide to stop working at any time. Each session was facilitated by research staff and implemented one to three times per week from August to January (except for a school break in December) during students' study hall or elective periods, so as not to disrupt core academic class time.

To measure academic performance, researchers collected students' grades in Hindi, English, and Math at the middle and end of the school year. For a subset of schools, researchers also collected grades from the previous year to serve as a comparison. To measure cognitive endurance, researchers administered listening comprehension, cognitive, and math tests to students four times during the school year. For each test, researchers randomly ordered the test questions so that they could predict the rate at which student performance declined over the course of a test. Finally, researchers conducted a series of psychological tests to measure students' levels of sustained attention. Classroom observers also used an ADHD diagnostic scale to rate students' behavior and attentiveness in their regular classrooms throughout the year.

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Results show that students that spent additional time engaging in sustained cognitive effort received higher grades in all of their classes, improved their performance on tests, and appeared more attentive in the classroom.

Impact on school grades: Students in the Math and Games practice groups improved their grades by 0.08 to 0.09 standard deviations, with the largest impact in students' Hindi grades. This is a large effect on students' grades when compared to more time-consuming interventions. There was no noticeable difference between the impacts of the Math and Games practice groups on students' grades.

Impact on cognitive endurance: Students in the Math and Games practice groups increased their performance on questions in the second half of listening comprehension, cognitive, and math tests by 1.31 percentage points, relative to a baseline of -4.45 percentage points (a 21.9 percent improvement). Math and games practice had nearly the same effect on performance in the second half of tests.

Practicing sustained cognitive effort reduced the rate of performance decline on tests by 9.25 percentage points, with similar effects for both practice groups. This effect persisted after a 3 to 5-month break from school, although it is unclear whether it would persist over longer periods of time.

Impact on Attentiveness: Students in the Math practice group scored 0.05 standard deviations higher on a psychological test of attentiveness. There was no difference between the practice groups and the Study Hall group on the symbol matching task. Students in the Math practice group were also rated by classroom observers as 0.11 standard deviations more attentive during class than students in the comparison Study Hall.

Overall, researchers found that engaging in sustained cognitive effort increased students' performance in school by improving their capacity for cognitive endurance. While student motivation and perseverance may have also factored into these outcomes, results suggest that cognitive endurance played a major role in improving student learning and attentiveness.