Working Memory Training Improves Performance of Primary School Children: Evidence from a Randomized Field Experiment

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May 19, 2017

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Extended Abstract

Overview

Cognitive and socio-emotional skills substantially affect important individual life outcomes such as health, educational attainment, life satisfaction, and labor market outcomes. Working memory capacity is a key determinant for a wide range of cognitive and socio-emotional skills. Based on a large-scale randomized field experiment with about 600 first graders in Mainz/Germany we provide evidence on the causal effect of a five-week computer-based working memory training in the school context. Preliminary results point to substantial immediate and lasting (12 months) gains in working memory capacity; we further find far-transfer effects on schooling outcomes, with an increasing instead of fade-out pattern over time. Far-transfer effects seem to be mediated by training-related improvement in working memory capacity.

Study design

We conducted the study with about 600 first graders in 31 classes in Mainz/Germany. The intervention consisted of a five-week computer-based working memory training on a daily basis (24 school lessons of training time). The software provided an age-appropriate interface, adaptive levels of difficulty, and a motivating training environment. Control classes did usual classroom teaching; hence, we can estimate the effects

of using a computerized training software compared to standard class room teaching. We measured all our outcomes four times: pre- and post training, six months and one year after the training. Children completed highly standardized tests including cognitive and non-cognitive tasks as well as tasks on schooling achievements. Tests were conducted via headphone in front of large touchscreens to avoid training effects due to differences in experience with computers (working memory training was run with notebooks and mouses). Moreover, we had teachers and parents fill out questionnaires to control for additional variables like children's motivation and their parents' socio-economic status.

Hypotheses

Based on previous findings and our specific research design, we hypothesized that children in the treatment group (i) will have a higher working memory capacity, especially in visual-spatial WMC; (ii) will have better schooling achievements in working memory relevant areas of math and reading, especially in the long run; and (iii) will have better abilities to concentrate and focus as well as to inhibit unwanted responses.

Results

Randomization into treatment and control group worked for all our socio-demographic variables and baseline measures of our test outcomes. Our preliminary analysis points to a large and stable increase in near-transfer areas and gains in far-transfer tasks that are linked to the areas trained, while other far-transfer tasks are not affected by the training. The pattern over time for far-transfer outcomes seems to be increasing in contrast to a fade-out. We also analyze potential channels of our treatment effects and run several robustness checks, including a multiple testing corecction based on a stepdown-procedure by Romano and Wolf (2005).

Conclusion

To summarize, we conducted an intense, computer-based working memory training for primary school children. Results demonstrate that working memory training in comparison to usual classroom teaching led to substantial gains in close-to-training tasks and transfers of training gains to schooling outcomes. We also argue that these results are economically significant. We discuss limitations of our study design and carefully consider implications of our results for education policy.