Improving Reaction Time Improves Reading Fluency, a Common Cognitive Trait Associated with Dyslexia

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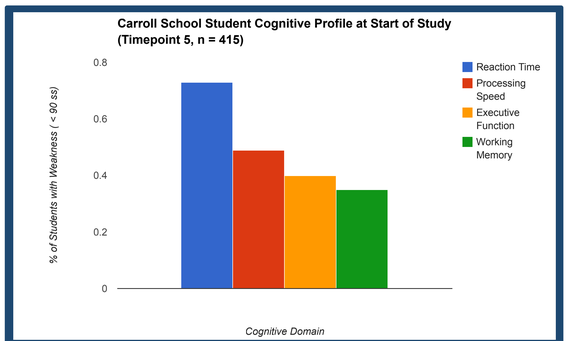
BACKGROUND

Many students with a language-based learning disability, such as dyslexia, have life-long struggles with reading fluency. The reasons why individual students are dysfluent often differ but include weakness in specific cognitive capacities. A promising, yet inadequately explored question is whether reading fluency might be improved by remediating key cognitive skills. Most previous work has targeted working memory and executive functions. In our current sample 80% of 415 Carroll School students have a weakness in a measure of cognitive fluency: reaction time (RT). To address this gap we investigate the efficacy of a computer-based cognitive intervention targeting RT.

Carroll School is an independent day school for students with diagnosed language-based learning disabilities such as dyslexia. Our diagnostic-prescriptive approach to instruction aims to mobilize students grades 1-9 to become active, self-aware learners while diminishing the obstacles associated with language-based learning disabilities.



Reaction time is the most common cognitive weakness (standard score of less than 90) of Carroll School students. 80% of students have an RT weakness while only 50% have a processing speed or working memory weakness.

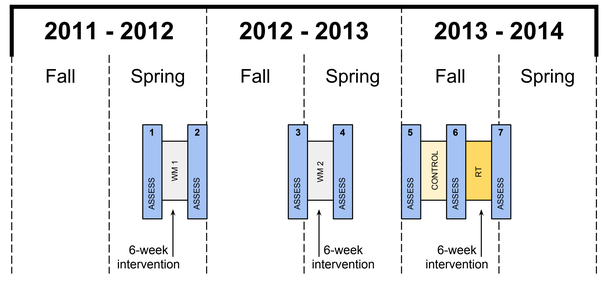
This study is the product of a Boston-based collaboration between:

Carroll School · Harvard Graduate School of Education · MIT · MGH Institute of Health Professions

METHODS

Our study took place over sixteen weeks in 2013-2014. This was part of a 3-year longitudinal effort. In week one, all 8th grade students underwent an 80-minute cognitive assessment battery including measures of reaction time (RT), processing speed, working memory, and executive functions and a timed 1-minute oral reading fluency assessment. Test results were used to identify students with an RT weakness (standard score below 90, n = 18).

This was followed by a six-week control period without any cognitive intervention. A second round of identical testing was then administered to assess natural changes in scores. Students then received six weeks of cognitive intervention for 20-30 minutes per day. This consisted of playing eight games using the CogniFit brain training platform (https://www.cognifit.com) that focused on improving quick, accurate, consistent decision making. None of these games involved reading practice. During week 16 students were post-tested to determine any changes in score resulting from the cognitive intervention.



This study focuses on 2013–2014 (timepoints 5 – 7). We have included 2011–2013 for context during which students received two, 6-week periods of working memory (WM) training (timepoints 1 – 4).

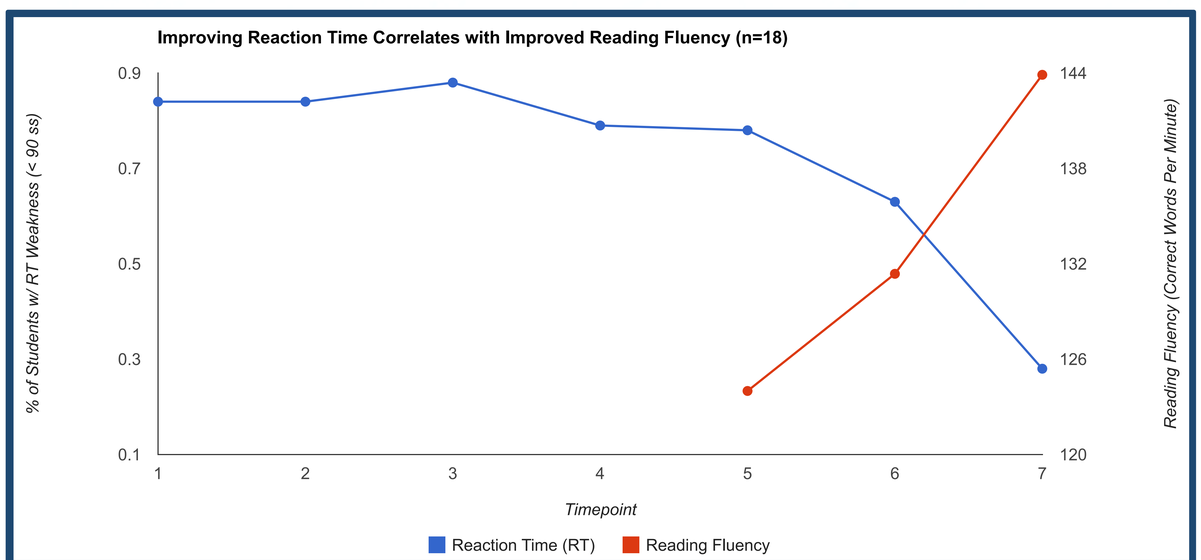
The player must hit the target mole on the head as fast as possible before they disappear.

The player is the motorcyclist and needs to change lanes to avoid collisions.

CogniFit PERSONALIZED BRAIN FITNESS PROGRAMS

RESULTS

Using multivariate analysis (MANOVA) we found that the students who received the RT cognitive intervention showed a significant improvement ($p < 0.01$) in RT and did not improve in non-targeted cognitive capacities. In addition reading fluency increased significantly more during the treatment interval than the control interval ($p < 0.03$).



Over three years of testing, approximately 80% of students consistently had an RT weakness (timepoints 1-5). After RT training only 30% of students have an RT weakness, a reduction of two-thirds. Growth in reading fluency (correct words per minute) was faster during the intervention period (timepoint 6-7) than during the control period (timepoints 5-6).

DISCUSSION

While much attention has focused on the cognitive capacities critical for beginning readers to learn to read, we hope our work will draw attention to the importance of cognitive systems required for students to read to learn. The low cost and convenience of using existing computer-based training makes this type of cognitive intervention broadly accessible to teachers and students almost anywhere in the world. These effective digital tools give teachers a way to provide differentiated instruction to students with diverse cognitive profiles. Additionally, the accessibility of the games allows students to improve their cognitive weaknesses by autonomously training both in and outside the classroom. We recommend further study to confirm that these results hold true in other contexts and better understand which interventions are appropriate during the course of literacy instruction.

CONTACT

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