

Intensive, Metronome-Based, 1-on-1 Cognitive Training Improves Cognitive Skills in Children

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INTRODUCTION

Background ThinkRx is a 60-hour clinician-delivered cognitive training program that targets multiple cognitive skills through repeated engagement in game-like but rigorous mental tasks in 60-90 minute training sessions at least three days per week. The intensity is tightly controlled by the clinician using a metronome, timer, and deliberate distractions to "load" the participant with several simultaneous tasks. Use of the metronome aids in increasing automaticity, creating intensity, improving processing speed, developing divided and sustained attention, and ensuring that mental breaks are minimized.



Reasoning training task

Theory Grounded in the Cattell-Horn-Carroll theory of intelligence (McGrew, 2005), the program is designed to enhance general intellectual ability by targeting multiple skills including working memory, long-term memory, processing speed, logic and reasoning, visual processing, auditory processing, and attention. The one-on-one delivery method of ThinkRx is supported by Feuerstein's theory of structural cognitive modifiability (Feuerstein, Feuerstein, & Falik, 2010), which describes the malleability of intelligence from mediated interactions with environmental stimuli.

Research Problem With few exceptions, commercially-available cognitive training programs are based on Baddeley's model of working memory rather than on a comprehensive theory of cognition. Thus, the outcomes from cognitive training research studies rarely indicate improvement in general intelligence. However, we recently reported a mean gain in IQ score of 21 points following 60 hours of one-on-one ThinkRx training (Carpenter, Ledbetter, & Moore, 2016). In the second phase of the study, we investigate further whether the delivery method influences the training outcomes.

METHODS

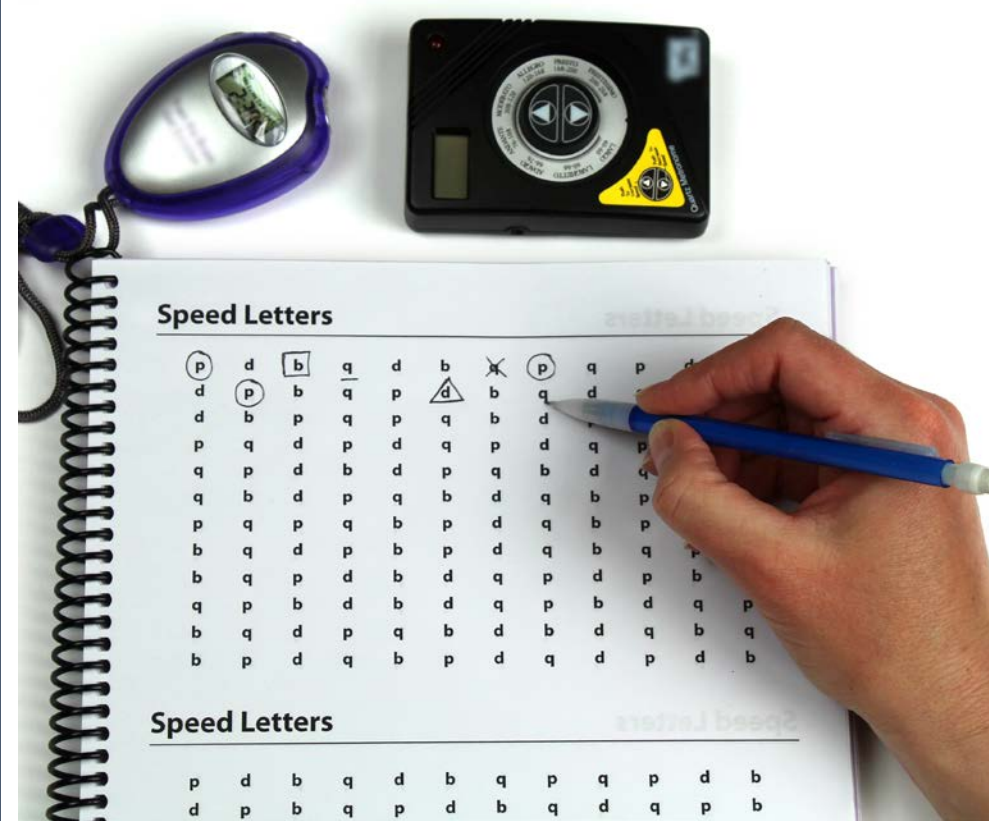
In a 2-phase randomized controlled trial, we examined the efficacy of ThinkRx cognitive training—an intensive, metronome-based cognitive training program—on IQ score, working memory, long-term memory, visual & auditory processing, processing speed, and reasoning for children ages 8-14 in a clinic setting. Then, we examined the differences between two methods of delivering ThinkRx. Pre and post training assessments included the Woodcock Johnson III – Tests of Cognitive Abilities.



Working memory training task

Phase 1 Participants ($n = 39$) were randomly assigned to either an experimental group ($n = 20$) to complete 60 hours of ThinkRx cognitive training or to a waitlist control group ($n = 19$). The experimental group attended forty 90-minute training sessions delivered one-on-one by a cognitive trainer.

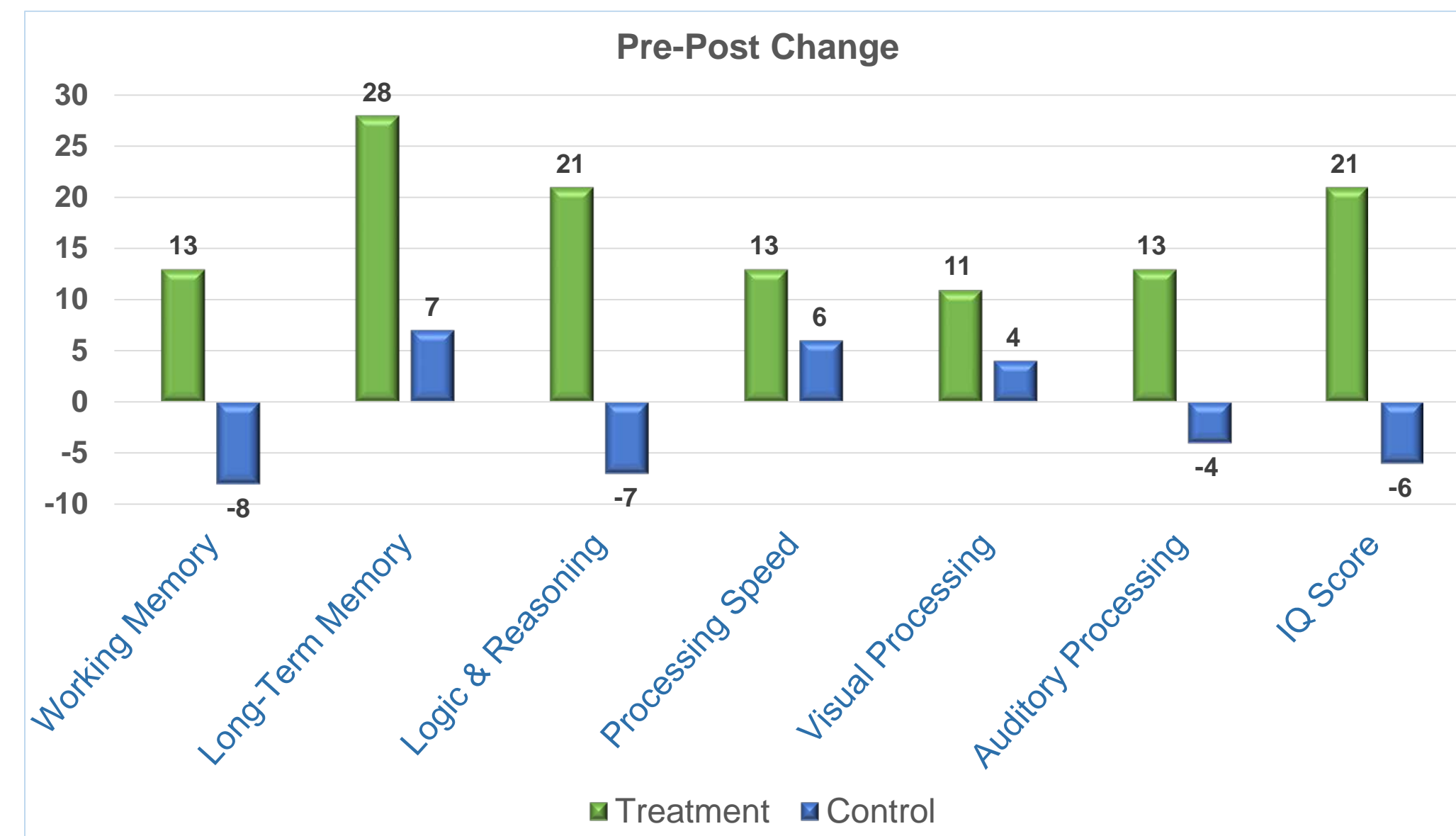
Phase 2 The waitlist control group from Phase 1 completed 60 hours of the same cognitive training program but with 30 hours delivered 1-on-1 by a cognitive trainer and 30 hours delivered through a digital platform called ThinkRx Digital. The training tasks in the digital version of the program mimicked the tasks in the 1-on-1 program.



Processing speed training task

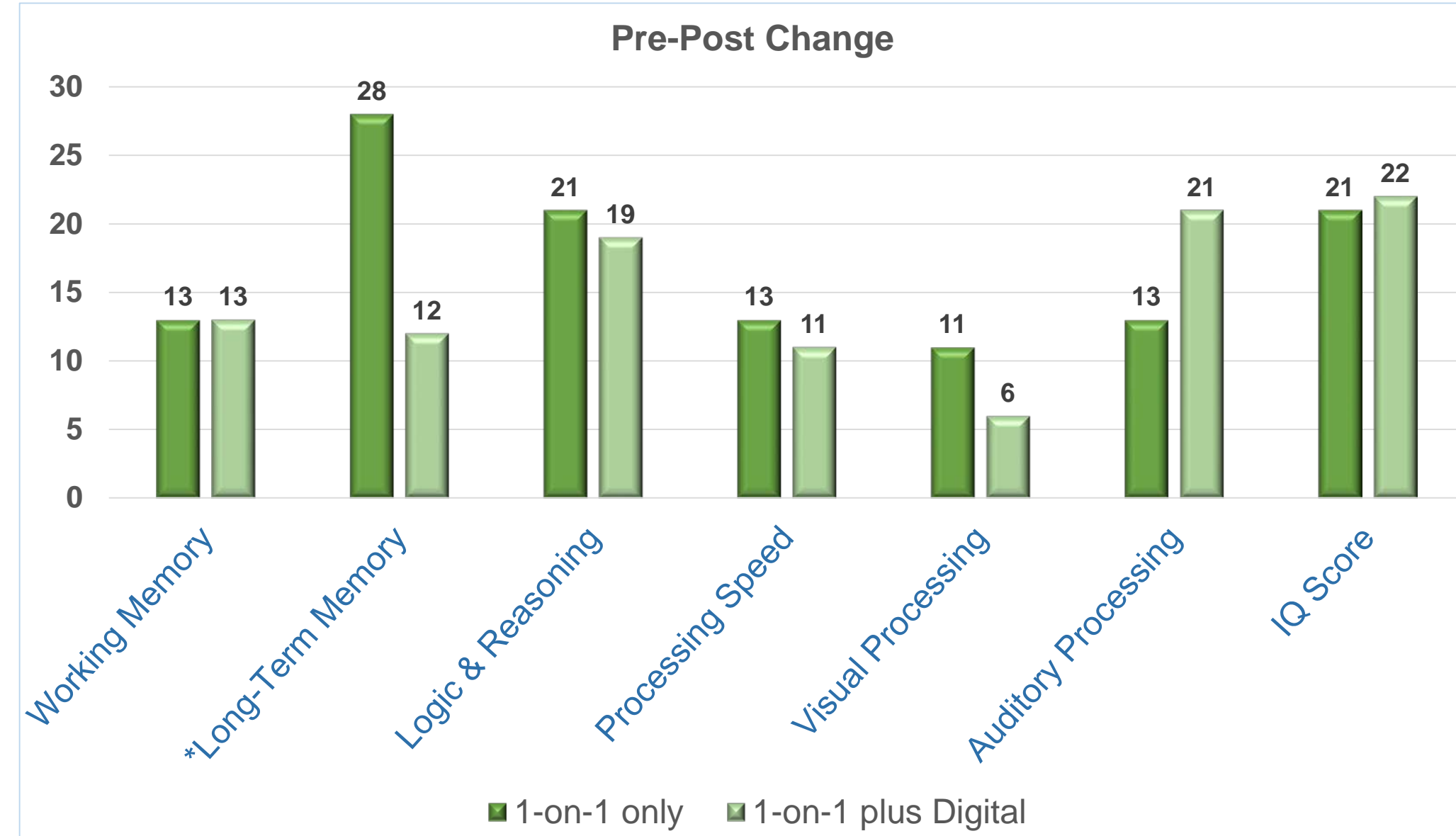
RESULTS

PHASE 1: Can clinician-delivered cognitive training increase IQ score and individual cognitive skills?



Phase 1 training effects included significant pretest to post-test gains on all measures, and a mean gain of 21 points in IQ score for the trained group. MANOVA results indicated an overall significant difference between treatment and control groups ($F = 15.83, p = .00, \text{partial } \eta^2 = .83$), with pairwise comparisons indicating significant differences on all measures.

PHASE 2: Can a combination of clinician-delivered and digital training increase IQ score and individual cognitive skills as well as clinician-delivery alone?



Phase 2 training effects included significant pretest to post-test gains on all measures, and a mean gain of 22 points in IQ score for the second trained group. Although MANOVA results revealed an overall significant difference between the 1-on-1 delivery group and the hybrid delivery group ($F = 3.36, p = .008, \text{partial } \eta^2 = .48$), pairwise comparisons only indicated a significant difference on long-term memory.

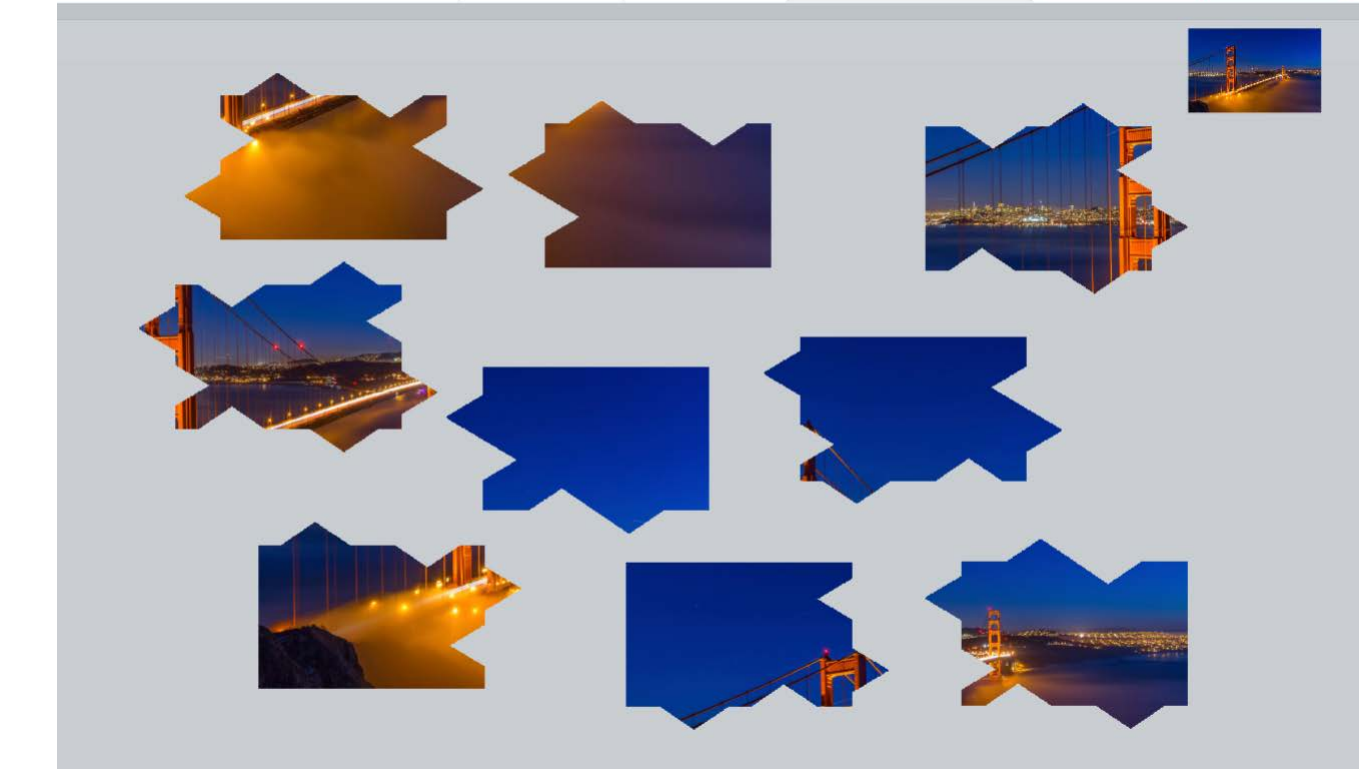
CONCLUSIONS



Clinician-delivered visual processing training task

- Accelerating the development and remediation of cognitive skills can be accomplished with ThinkRx, a comprehensive, clinician-delivered intervention that targets multiple cognitive skills.
- Both methods of delivering ThinkRx enhanced general intellectual ability and cognition in children.

- The combination delivery method was as effective as the clinician-only delivery method for improving all cognitive skills except for long-term memory.
- Adjustments to the combination delivery method are needed to address the discrepancy between delivery methods on long-term memory outcomes.



Digital delivery of a similar visual processing training task

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