CLIENT OUTCOMES AND RESEARCH RESULTS

LearningRx

2016 Edition

TABLE OF CONTENTS

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Forward

Executive processing is dependent upon the collective interplay of brain networks underlying fundamental cognitive skills. In ways, executive processing is only as strong as one's weakest skill. Cognitive training offers the most promising method for strengthening underlying cognitive networks allowing one to increase overall executive processing ability!

However, not all cognitive training programs are alike! LearningRx is distinct in many ways. Foremost, LearningRx programs are delivered by a clinician who gives dynamic feedback throughout every training session. Further, LearningRx programs are based on the Cattell-Horn-Carrol theory of intelligence, a widely-accepted view of cognition and the theoretical foundation of modern day cognitive assessment. LearningRx is comprehensive, targeting and training of seven key cognitive skills and multiple subskills. It is also highly intensive, including 120+ hours of training.

The dynamic feedback, thoroughness, & intensity of LearningRx cognitive training are key to produce long term, lasting modifications of cognitive skills networks & thus the long lasting gains desired!

Sincerely,

Christina Ledbetter, PhD
Neuroscientist and Research Fellow, LSU Health Sciences Center

Introduction

Since 1985, Dr. Ken Gibson and his colleagues have helped over 95,000 clients with a unique cognitive training methodology designed to remediate deficits in multiple underlying learning skills. Dr. Gibson has devoted his entire career to helping children and adults with learning struggles, beginning first with a visual information processing intervention and later restructuring the program to include auditory processing, memory, attention, processing speed, and reasoning training procedures. Surrounding himself with a team of psychologists, educators, speech and language pathologists, and occupational therapists, Dr. Gibson has continuously studied the results of learning and cognition research to inform the development of an intensive reading intervention, a math intervention, and a reading comprehension intervention that have complemented the original training program.

Today, his focus has turned to building an empirical research base that supports the cognitive training procedures and assessments used by LearningRx brain training centers, and to the continued development and testing of cognitive training program components. He established the Gibson Institute of Cognitive Research in April 2014 to accomplish those goals. The mission of the Gibson

Institute is to conduct research on the programs and assessments, to communicate the latest research findings to the education and cognitive science communities, to provide opportunities for outside researchers to participate in research projects that utilize our cognitive training and assessment instruments, and to inform the practices of cognitive trainers by translating research findings into real-world applications. This report provides an overview of the LearningRx client outcomes from 2010 to 2015 and summarizes the major research on LearningRx programs.

With warm regards,

Amy L. Moore, PhD
Educational Psychologist and
Research Director, Gibson Institute
of Cognitive Research

LearningRx Client Outcomes: 2010–2015

Executive Summary

Introduction

This report presents a national assessment of the training impacts on cognitive skills and on reading and math achievement for nearly 18,000 clients of LearningRx brain training centers between 2010 and 2015.

Background

LearningRx is a supplemental educational services provider of brain training and cognitive-focused reading and math interventions for students. The services are based on a cognitive training approach to reducing deficits in cognition, reading, and math skills. The services are currently provided at 80 LearningRx Centers across the United States. Each center is an independently-owned franchise that implements the LearningRx proprietary programs, including ThinkRx, ReadRx, MathRx, ComprehendRx, and LiftOff!

Clients in the ThinkRx, ReadRx, MathRx, and ComprehendRx programs complete a battery of tests from the Woodcock Johnson III—Tests of Achievement and Tests of Achievement before and after training.

Characteristics of Clients Served between 2010 and 2015

Training Program	# Clients	% of Clients	Average Age	# Training Hours
ThinkRx	7,138	40	13.7	60–90
ReadRx	6,460	36	11.4	120
MathRx	1,368	8	13.2	120
LiftOff	1,245	7	6.2	60
ComprehendRx	358	2	13.1	40

Summary of Findings

To assess the outcomes for clients between 2010 and 2015, pre-intervention test scores were compared to post-intervention test scores using paired samples t tests. Training gains were examined in three ways: a pooled analysis of test data across all clientele, analysis of test data based on self-reported diagnosis, and analysis of test data based on training program. The analyses revealed positive trends and significant training gains for all LearningRx programs and all diagnostic categories.

> *Gains by Program.* When the Woodcock Johnson III standard score results from clients in each program are compared in a table, we can see the mean gain for each cognitive skill by program and as a whole, and also the average gain for all cognitive skills for each program and as a whole.

Table of Cognitive Skill Standard Score Gains by Program

Skill	MathRx	ThinkRx	ReadRx	ComprehendRx	Skill Mean
IQ	13	17	13	15	14.9
Long-Term Memory	15	15	14	14	14.3
Processing Speed	13	12	12	11	11.6
Logic & Reasoning	12	11	11	10	10.8
Auditory Processing	9	10	11	10	10.4
Working Memory	11	10	10	9	9.6
Broad Attention	10	8	8	8	8.3
Visual Processing	9	8	8	8	8.0
Program Mean	11.5	11.4	10.8	10.7	11.1

- Overall, LearningRx clients made the greatest gains in IQ and long-term memory, followed by processing speed, logic & reasoning, and auditory processing.

- ThinkRx clients achieved the greatest gains in IQ score, averaging 17 points, versus a 15 point gain for ComprehendRx clients and a 13 point gain for MathRx and ReadRx clients.

- ReadRx clients made the greatest gains in auditory processing and MathRx clients made the greatest gains in processing speed.

- As a group, ThinkRx clients averaged a 17 point gain in IQ score and an 11.4 standard point gain on tests of cognitive skills, including long-term memory, broad attention, logic and reasoning, auditory processing, working memory, visual processing, and processing speed.

- As a group, ReadRx clients averaged a 13 point gain in IQ score, a 10.8 standard point gain on tests of cognitive skills, and made statistically significant gains on tests of Reading Fluency, Word Attack, Spelling Sounds, Sound Awareness, and Passage Comprehension. The mean gain across reading achievement tests was 3.5 years.

- As a group, MathRx clients averaged a 13 point gain in IQ score, an 11.5 standard point gain on tests of cognitive skills, and made statistically significant gains on tests of Math Fluency, Applied Problems, Decision Speed, and Quantitative Concepts. The mean gain across math achievement tests was 3.4 years.

- As a group, ComprehendRx clients averaged a 15 point gain in IQ score, an 10.7 standard point gain on tests of cognitive skills, and made statistically significant gains on tests of Reading Fluency, Word Attack, Listening Comprehension, Sound Awareness, and Passage Comprehension. The mean gain across reading achievement tests was 3.8 years.w

Gains by Diagnosis. When the Woodcock Johnson III standard score results from clients with different diagnoses are compared in a table, we can see the mean gain for each cognitive skill by diagnosis and as a whole, and also the average gain in all cognitive skills for each diagnosis and as a whole.

Table of Standard Score Cognitive Skill Gains by Diagnosis

Skill	ADHD	Memory Loss	Dyslexia	Autism	TBI	LD	Speech	Skill Mean
Auditory Processing	14	14	14	14	15	15	15	14.4
Long-Term Memory	14	15	14	13	14	14	13	13.9
IQ	14	19	13	9	9	9	9	11.7
Logic & Reasoning	11	10	12	11	11	11	11	11.0
Broad Attention	12	7	11	11	11	11	10	10.4
Working Memory	10	10	9	11	10	10	10	10.0
Processing Speed	9	6	8	10	9	9	9	8.6
Visual Processing	11	9	8	8	8	8	8	8.6
Disorder Mean	11.9	11.3	11.1	10.9	10.9	10.9	10.6	11.1

- All cognitive skills gains were statistically significant regardless of diagnosis.

- Clients who came to LearningRx with a prior diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) achieved the greatest gains overall, averaging 11.9 standard score points across cognitive skills.

- Clients over the age of 50 who came to LearningRx with age-related memory loss made the greatest gains in IQ score, averaging a 19 point increase. Clients with ADHD averaged a 14-point increase in IQ score and clients with dyslexia average a 13 point increase. The average increase in IQ score for all diagnostic categories combined was 11.7 points.

- As a group, clients who came to LearningRx with a diagnosis made the greatest gains in auditory processing and long-term memory, followed by IQ score and logic and reasoning.

The Science Behind LearningRx One-on-One Brain Training

The Learning Model is grounded in the Cattell-Horn-Carrol (CHC) theory of intelligence, which describes thinking as a set of seven broad abilities: comprehension knowledge, long-term retrieval, visual-spatial thinking, auditory processing, fluid reasoning, processing speed, and short-term memory.
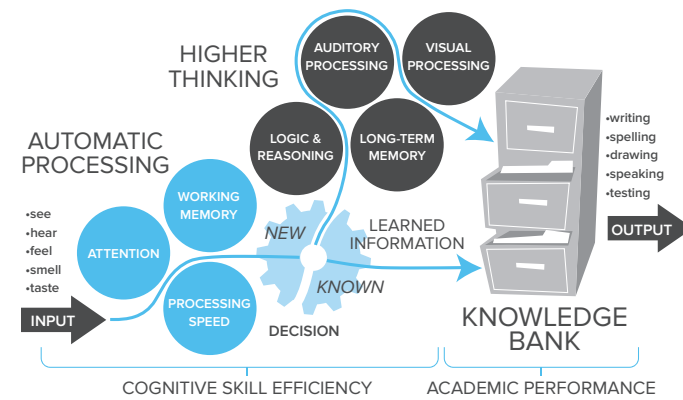
According to the Learning Model, an individual takes information in through the senses (input) that must be recognized and analyzed by the active processing system (working memory, processing speed, attention). This executive control system determines which information is unimportant, easily handled, or requires thinking. Unimportant information is discarded from working memory. If the input contains important information about data that have already been stored in the knowledge bank, it is quickly retrieved and converted to output such as speaking or writing.

If the information has not been previously stored, higher thinking processes must then occur. Reasoning, auditory processing, and visual processing must be used to solve the problem or complete the task. If the task is practiced often enough, however, the information is stored in the knowledge bank, which will decrease the time between input to output. This occurs because the higher thinking processes can then be bypassed.

7 KEY COGNITIVE SKILLS

- **Attention:** Focus over time, despite distraction, and while multitasking

- **Processing Speed:** Think and perform tasks quickly and accurately

- **Working Memory:** Hold on to and use information during the learning process

- **Auditory Processing:** Distinguish, blend, and segment sounds accurately

- **Visual Processing:** Create and picture mental images while thinking or reading

- **Logic & Reasoning:** Reason, form ideas, and solve problems

- **Long-Term Memory:** Efficiently recall facts and stored information

LearningRx Cognitive Training

LearningRx cognitive training programs target and remediate seven primary cognitive skills and multiple sub-skills through repeated engagement in game-like mental tasks delivered one-on-one by a clinician or cognitive trainer. The tasks emphasize visual or auditory processes that require attention and reasoning throughout each 60 to 90 minute training period. Using a synergistic "drill for skill" and meta-cognitive approach to developing cognitive skills, the program incorporates varying levels of intensity, hierarchical sequencing of tasks, multiple task loading, and instant feedback from the clinician. Training sessions are focused, demanding, intense, and tightly controlled by the clinician to push students to just above their current cognitive skill levels. Deliberate distractions are built in to the sessions to tax the brain's capacity for sorting and evaluating the importance of incoming information. This ability to correctly handle distracting information and interruptions is the foundation for focus and attention skills

THE SEVEN KEY INGREDIENTS OF EFFECTIVE BRAIN TRAINING

Brain training must be practiced. Because brain training builds skills, it can't be taught in the classroom. It must be practiced, like learning to play tennis or the piano.

Brain training that gets the best results is done one-on-one with a personal trainer. Teaming with an experienced trainer provides accountability, motivation and—ultimately—life-changing results.

Brain training exercises need to be intense, requiring concentrated repetitions in order to train skills quickly.

Brain training exercises need to be targeted in order to address specific weak cognitive skills.

Brain training exercises need to be done in a particular sequence. Small challenging steps don't overwhelm the client, but allow the trainer to continually challenge the client incrementally and keep them engaged in the training.
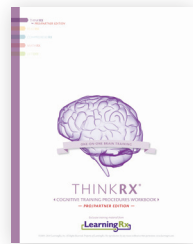
Brain training exercises must be progressively loaded. Loading incorporates multi-tasking and is a fast-track way to take a new skill and make it a more automatic skill.

Brain training, to be effective, requires immediate, accurate feedback. Instant, effective reinforcement and adjustments keep training focused and intense.

Profile of LearningRx Programs

Years:	2010–2015
% of Clients:	40%
# Clients:	7,138
Average age:	13.7
# training hours:	-90

ThinkRx is the foundational one-on-one cognitive training program for clients ages 6 to adult. ThinkRx includes 35 training procedures that target all major cognitive skills including attention, memory, processing speed, auditory and visual processing, and logic and reasoning.
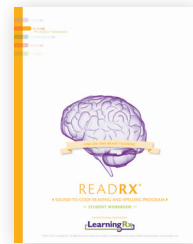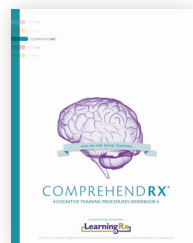

Years:	2010–2015
% of Clients:	36%
# Clients:	6,460
Average age:	11.4
# training hours:	120

ReadRx is an intensive sound-to-code reading and spelling intervention for clients ages 6 to adult. ReadRx includes all 35 ThinkRx training procedures and adds an additional 60 hours of training in auditory processing along with basic and complex code to increase reading and spelling fluency.
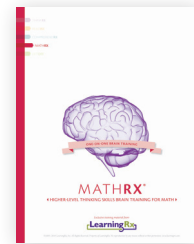
Years:	2010–2015
% of Clients:	8%
# Clients:	1,368
Average age:	13.2
# training hours:	120

MathRx is an intensive math intervention for clients ages 6 to adult. MathRx includes all 35 ThinkRx training procedures and adds an additional 60 hours of training in math concepts, problem solving, reasoning, and calculations designed to increase mathematical fluency.

Years:	2014–2015
% of Clients:	2%
# Clients:	358
Average age:	13.1
# training hours:	40

ComprehendRx is an add-on training to improve reading comprehension and metacognition.

| Years: | 2010–2015 |
% of Clients:	7%
# Clients:	1,245
Average age:	6.2
# training hours:	60

LiftOff is a reading readiness and cognitive skills training intervention for 4–7 year olds.

*An additional 1429 clients were enrolled in short booster programs without cognitive testing.

Profile of LearningRx Clients

Number of Clients in 2010-2015

Age	Number
50+	262
25-49	509
19-24	653
16-18	1334
13-15	3118
9-12	6966
6-8	4652
3-5	504
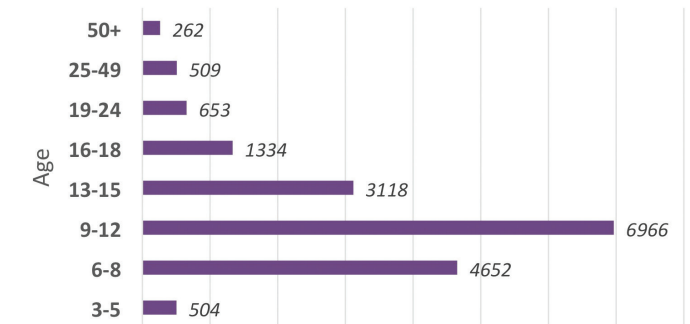
Percentage with a Prior Diagnosis	
Attention Deficit Hyperactivity Disorder (ADHD)	30
Dyslexia	12
Learning Disability	11
Speech/Language Delay	10
Autism Spectrum Disorder	5
Traumatic Brain Injury	2
Age Relaged Memory Loss	<1

Gender	
Female	40
Male	60

LearningRx Assessments and Interpretation of Results

LearningRx clients take a battery of cognitive and achievement tests before they begin a training program and then again at the end of their training. Test administrators use subtests from the Woodcock Johnson III family of tests, including Tests 1-7 of the cognitive battery to derive an IQ score. The selection of supplemental tests is determined by the training program in which clients are enrolled. Pretest to post-test changes in standard scores are statistically analyzed using paired samples t tests. Percentiles and age-equivalents are reported to show the distribution of scores relative to same age peers.

Woodcock Johnson III - Tests of Cognitive Abilities (COG)

Test	Test Name	Skill Measured	Clients
COG 1	Verbal Comprehension	General Knowledge	All
COG 2	Visual-Auditory Learning	Long-Term Memory	All
COG 3	Spatial Relations	Visual Processing	All
COG 4	Sound Blending	Auditory Processing	All
COG 5	Concept Formation	Logic & Reasoning	All
COG 6	Visual Matching	Processing Speed	All
COG 7	Numbers Reversed	Working Memory	All
COG 9	Auditory Working Memory	Auditory Working Memory	ReadRx
COG 15	Analysis-Synthesis	Fluid Reasoning	MathRx
COG 16	Decision Speed	Cognitive Fluency	MathRx
COG 20	Pair Cancellation	Broad Attention	All

Woodcock Johnson III - Tests of Achievement (ACH)

Test	Test Name	Skill Measured	Clients
ACH 2	Reading Fluency	Broad Reading	ReadRx
ACH 4	Understanding Directions	Listening Comprehension	ReadRx/ComprehendRx
ACH 6	Math Fluency	Broad Math	MathRx
ACH 9	Passage Comprehension	Reading Comprehension	ReadRx/ComprehendRx
ACH 13	Word Attack	Word Attack	All
ACH 18	Quantitative Concepts	Math Reasoning	MathRx
ACH 20	Spelling of Sounds	Phonemic Awareness	ReadRx
ACH 21	Sound Awareness	Auditory Processing	All

CLIENT OUTCOMES BY PROGRAM

All Programs

ThinkRx

ReadRx

MathRx

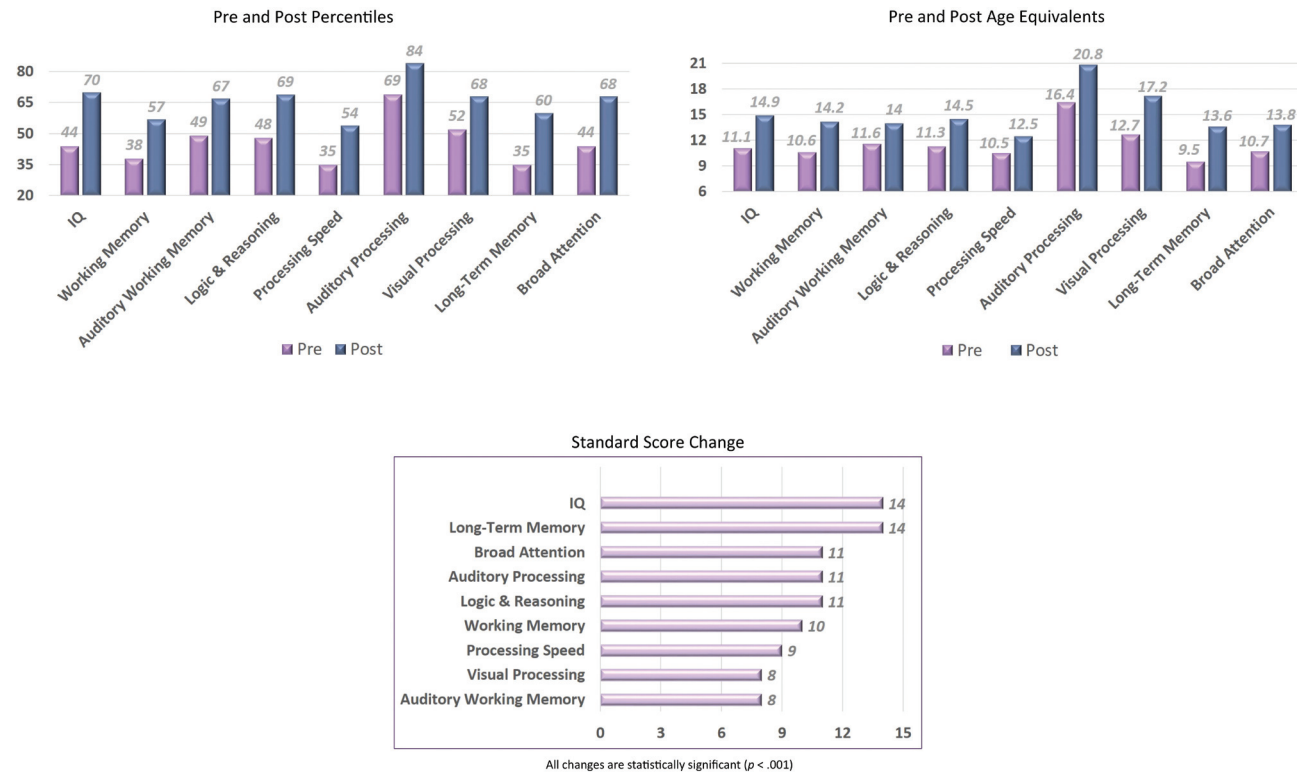ComprehendRx

Cognitive Assessment Results: 2010–2015

Program: All programs

Number of Clients: 17,998

Mean Age: 12.3

Results: LearningRx clients are given pre and post assessments using the Woodcock Johnson III – Tests of Cognitive Abilities. The changes in standard scores were statistically significant for all measures (p< .001). Overall, the largest gains were seen in IQ and long-term memory, followed by broad attention, auditory processing, and logic and reasoning. The average pretest IQ score was 97 and the average post-test IQ score was 111. In addition, post-training percentiles are well within the range of normal functioning, and the average age-equivalent gain in cognitive skill performance was 3.4 years.

Pre and Post Percentiles

Pre and Post Age Equivalents

Standard Score Change

All changes are statistically significant (*p* < .001)
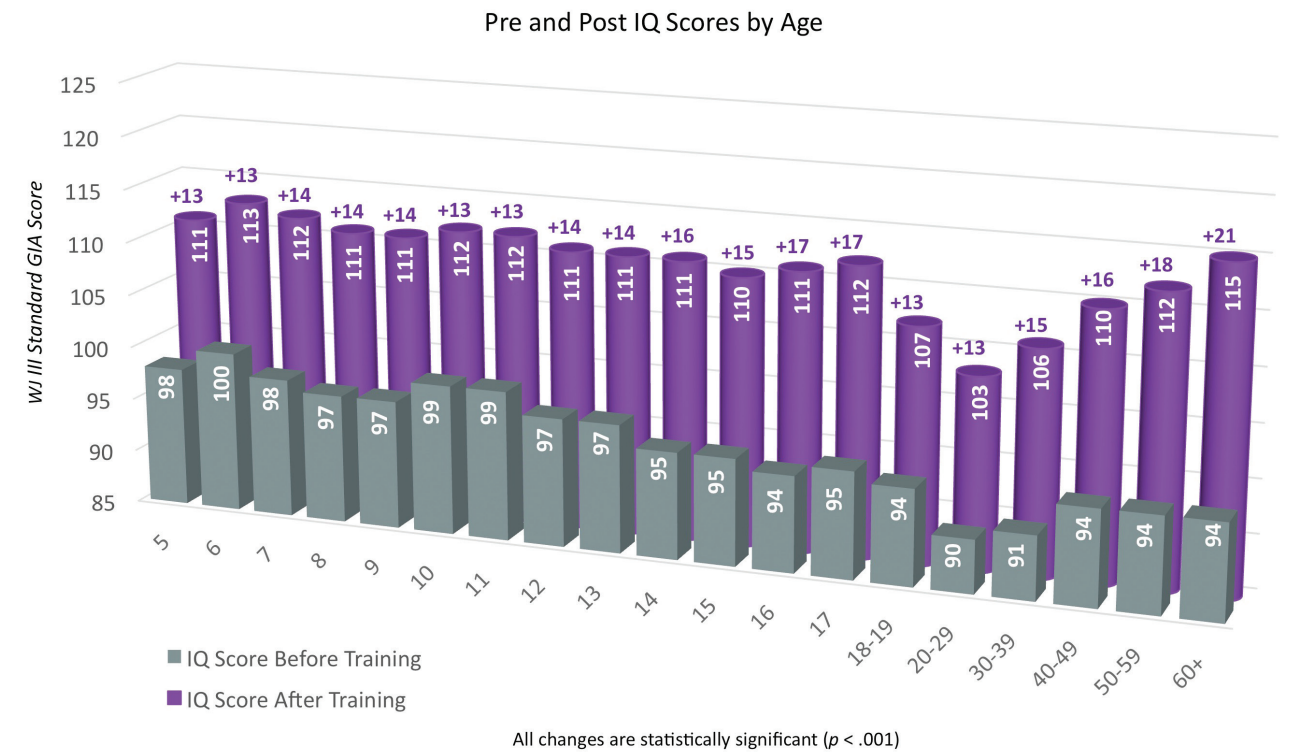
IQ Score Results: 2010–2015

Program: All programs

Number of Clients: 17,998

Mean Age: 12.3

Results: LearningRx clients are given pre and post assessments using the Woodcock Johnson III – Tests of Cognitive Abilities. A majority of clients take the seven subtests required to calculate an IQ Score, or General Intellectual Ability score. The changes in IQ scores were statistically significant for all measures (p < .001). The average pretest IQ score was 97 and the average post-test IQ score was 111. Mean gains ranged from 13 points to 21 points across age groups.

Pre and Post IQ Scores by Age

All changes are statistically significant (*p* < .001)

ThinkRx Cognitive Results: 2010–2015

Program:	ThinkRx
Number of Clients:	7,138
Mean Age:	13.7
Results:	The changes in standard scores on the Woodcock Johnson III — Tests of Cognitive Abilities were statistically significant for all skills (p< .001) assessed. Overall, the largest gains were seen in IQ and long-term memory, followed by broad attention, auditory processing, and logic and reasoning. The average pretest IQ score was 100 and the average post-test IQ score was 117. In addition, post-training percentiles are well within the range of normal functioning, and the average age-equivalent gain in cognitive skill performance was 3.4 years.
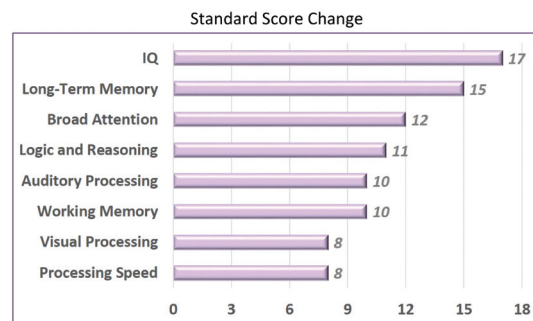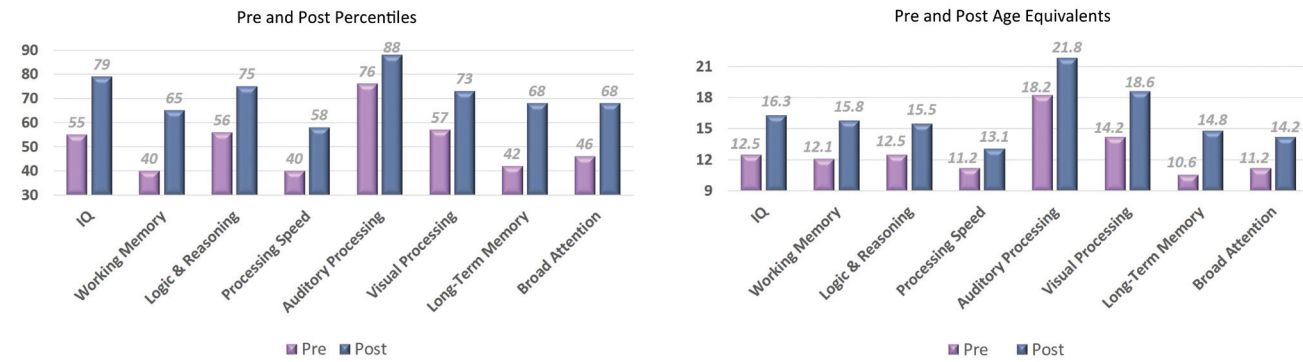
ReadRx Achievement Results: 2010–2015

Program:	ReadRx
Number of Clients:	6,460
Mean Age:	11.4
Results:	Clients who completed the 120-hour ReadRx program achieved statistically significant standard score changes (p< .001) on all five reading subtests administered from Woodcock Johnson III — Tests of Achievement. Overall, the largest gain was seen in sound awareness, the primary skill needed for reading. Post-training percentiles are all within the normal range, and the overall age-equivalent gain in reading achievement was 3.5 years.

Pre and Post Percentiles (ThinkRx)

IQ: Pre 55, Post 79
Working Memory: Pre 40, Post 65
Logic & Reasoning: Pre 56, Post 75
Processing Speed: Pre 40, Post 58
Auditory Processing: Pre 76, Post 88
Visual Processing: Pre 57, Post 73
Long-Term Memory: Pre 42, Post 68
Broad Attention: Pre 46, Post 68

Pre and Post Age Equivalents (ThinkRx)

IQ: Pre 12.5, Post 16.3
Working Memory: Pre 12.1, Post 15.8
Logic & Reasoning: Pre 12.5, Post 15.5
Processing Speed: Pre 11.2, Post 13.1
Auditory Processing: Pre 18.2, Post 21.8
Visual Processing: Pre 14.2, Post 18.6
Long-Term Memory: Pre 10.6, Post 14.8
Broad Attention: Pre 11.2, Post 14.2

■ Pre   ■ Post

Standard Score Change (ThinkRx)

Skill	Change
IQ	17
Long-Term Memory	15
Broad Attention	12
Logic and Reasoning	11
Auditory Processing	10
Working Memory	10
Visual Processing	8
Processing Speed	8

All changes are statistically significant (*p* < .001)

Pre and Post Percentiles (ReadRx)

Word Attack: Pre 35, Post 52
Spelling Sounds: Pre 40, Post 52
Sound Awareness: Pre 38, Post 68
Comprehension: Pre 32, Post 47
Reading Fluency: Pre 36, Post 48

Pre and Post Age Equivalents (ReadRx)

Word Attack: Pre 9.4, Post 12.8
Spelling Sounds: Pre 10.3, Post 12.9
Sound Awareness: Pre 10.3, Post 16.5
Comprehension: Pre 10, Post 13
Reading Fluency: Pre 10.4, Post 12.5

■ Pre   ■ Post

Standard Score Change (ReadRx)

Skill	Change
Sound Awareness	14
Word Attack	7
Comprehension	7
Reading Fluency	6
Spelling Sounds	5

All changes are statistically significant (*p* < .001)

MathRx Achievement Results: 2010–2015

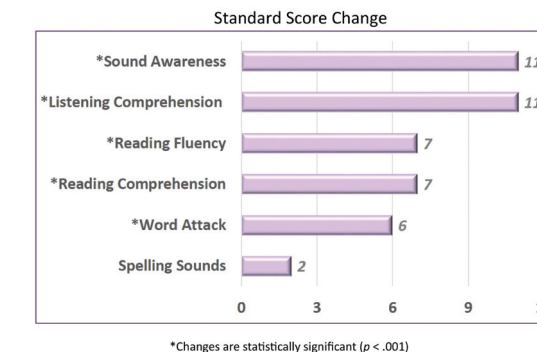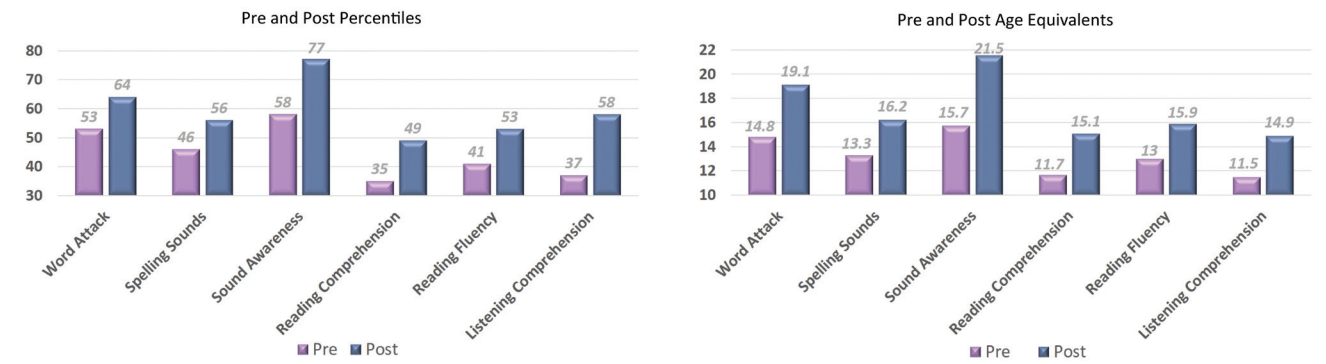|	
Program:	MathRx
Number of Clients:	1,368
Mean Age:	13.2
Results:	Clients who completed the 120-hour MathRx program achieved statistically significant standard score changes (p < .001) on the assessment of math skills selected from Woodcock Johnson III — Tests of Achievement and Tests of Achievement. Post-training percentiles are all within the normal range, and the overall age-equivalent gain in math skills was 3.4 years.

Pre and Post Percentiles

Pre and Post Age Equivalents

Standard Score Change

All changes are statistically significant (*p* < .001)
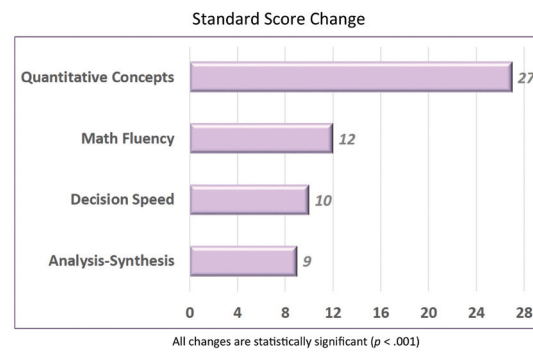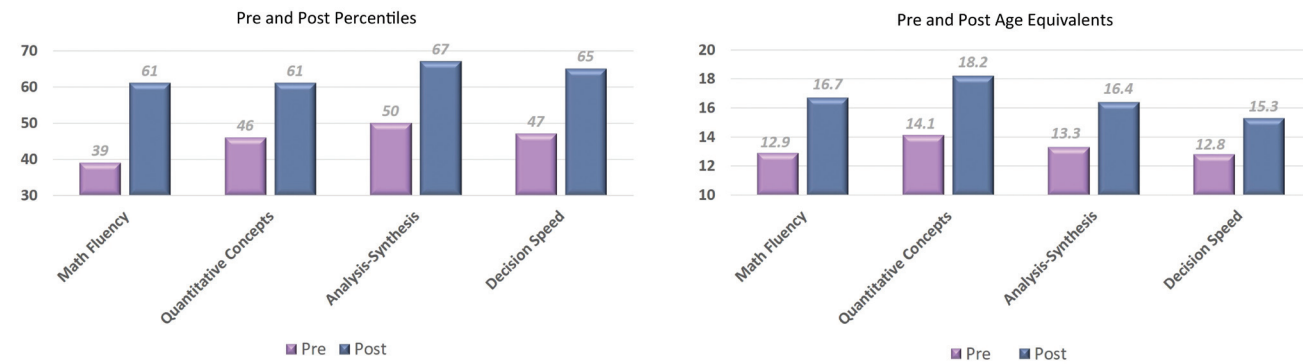
ComprehendRx Achievement Results: 2010–2015

Program:	ComprehendRx
Number of Clients:	358
Mean Age:	13.1
Results:	Clients who completed the 160-hour ComprehendRx program achieved statistically significant standard score changes (p< .001) on five of the six reading subtests administered from Woodcock Johnson III — Tests of Achievement Overall, the largest gain was seen in sound awareness, the primary skill needed for reading. Substantial gains were also noted in listening comprehension. Post-training percentiles are all within the normal range, and the overall age-equivalent gain in reading achievement was 3.8 years.

Pre and Post Percentiles

Pre and Post Age Equivalents

Standard Score Change

*Changes are statistically significant (*p* < .001)

CLIENT OUTCOMES BY SUBGROUPS

Attention Deficit Hyperactivity Disorder
Traumatic Brain Injury
Learning Disability
Dyslexia
Speech and Language Disorder
Autism Spectrum Disorder
Age-Related Memory Loss

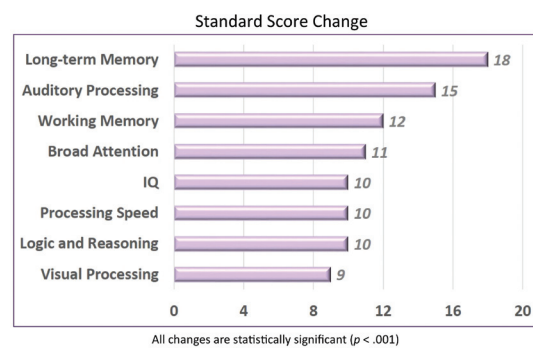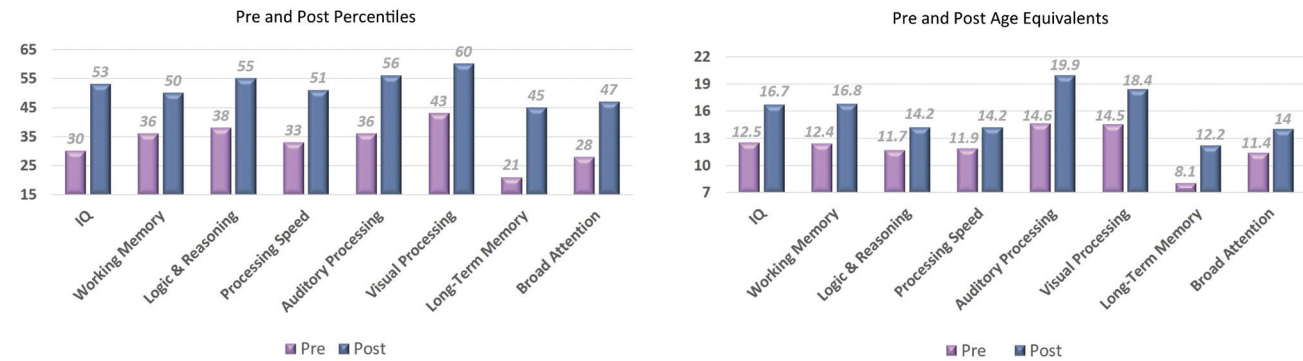**Cognitive Assessment Results by Client-Reported Diagnosis**

Attention Deficit/Hyperactivity Disorder

Program:	All
Number of Clients:	5,416
Mean Age:	12.3

Results: The following charts show the changes in cognitive skills for clients who came to LearningRx with a diagnosis of ADHD between 2010 and 2015. The changes in standard scores on the Woodcock Johnson III – Tests of Cognitive Abilities were statistically significant for all skills (p< .001) assessed. Overall, the largest gains were seen in IQ, auditory processing, and long-term memory, followed by broad attention and logic and reasoning. The average pretest IQ score was 96 and the average post-test IQ score was 110. In addition, post-training percentiles are well within the range of normal functioning, and the average age-equivalent gain in cognitive skill performance was 3.7 years.

Pre and Post Percentiles

Pre and Post Age Equivalents

Standard Score Change

All changes are statistically significant ($p < .001$)

Cognitive Assessment Results by Client-Reported Diagnosis

Traumatic Brain Injury

Program:	All
Number of Clients:	273
Mean Age:	25.6

Results: The following charts show the changes in cognitive skills for clients who came to LearningRx with a diagnosis of Traumatic Brain Injury (TBI) between 2010 and 2015. The changes in standard scores on the Woodcock Johnson III – Tests of Cognitive Abilities were statistically significant for all skills (p< .001) assessed. Overall, the largest gains were seen in auditory processing and long-term memory, followed by working memory and broad attention. The average pretest IQ score was 92 and the average post-test IQ score was 102. In addition, post-training percentiles are within the range of normal functioning, and the average age-equivalent gain in cognitive skill performance was 3.7 years.
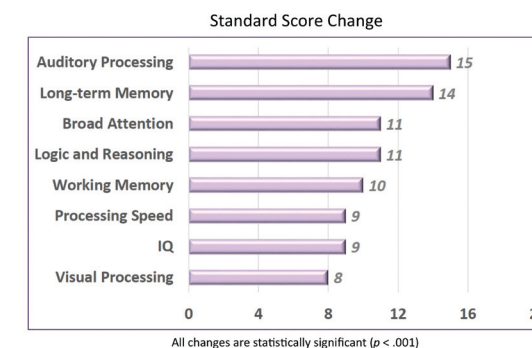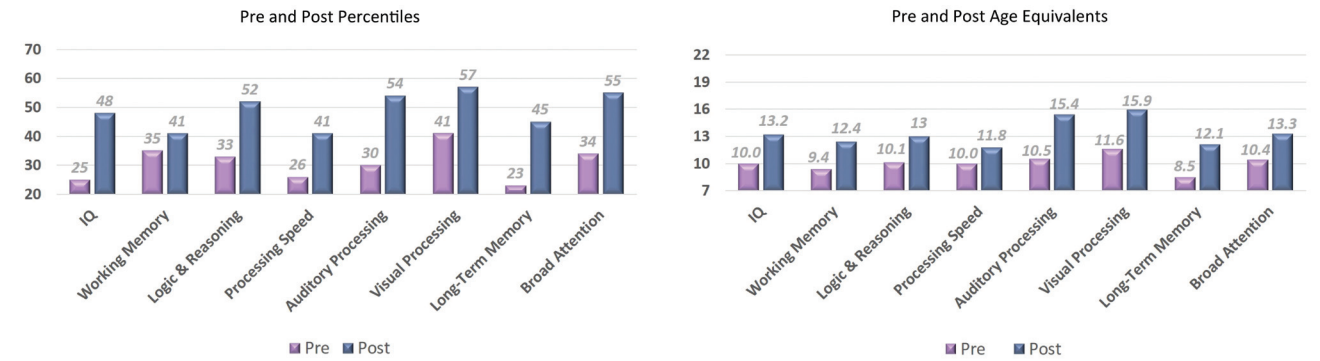
Pre and Post Percentiles

Pre and Post Age Equivalents

Pre ■ Post

Standard Score Change

Long-term Memory	18
Auditory Processing	15
Working Memory	12
Broad Attention	11
IQ	10
Processing Speed	10
Logic and Reasoning	10
Visual Processing	9

All changes are statistically significant (p < .001)

Cognitive Assessment Results by Client-Reported Diagnosis

Learning Disability (LD)

Program:	All
Number of Clients:	2003
Mean Age:	13.1

Results: The following charts show the changes in cognitive skills for clients who came to LearningRx with a diagnosis of Learning Disability (LD) between 2010 and 2015. The changes in standard scores on the Woodcock Johnson III – Tests of Cognitive Abilities were statistically significant for all skills (p< .001) assessed. Overall, the largest gains were seen in auditory processing and long-term memory, followed by logic and reasoning and broad attention. The average pretest IQ score was 90 and the average post-test IQ score was 99. In addition, post-training percentiles are within the range of normal functioning, and the average age-equivalent gain in cognitive skill performance was 3.3 years.

Pre and Post Percentiles

Pre and Post Age Equivalents

Pre ■ Post

Standard Score Change

Auditory Processing	15
Long-term Memory	14
Broad Attention	11
Logic and Reasoning	11
Working Memory	10
Processing Speed	9
IQ	9
Visual Processing	8

All changes are statistically significant (p < .001)

Cognitive Assessment Results by Client-Reported Diagnosis
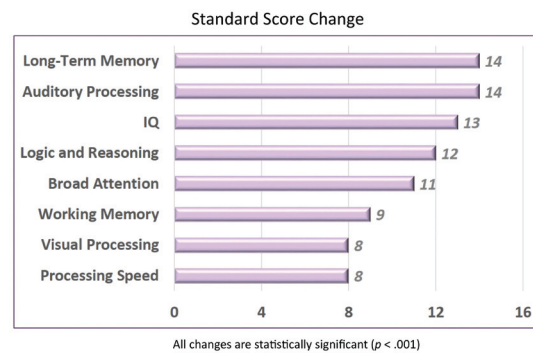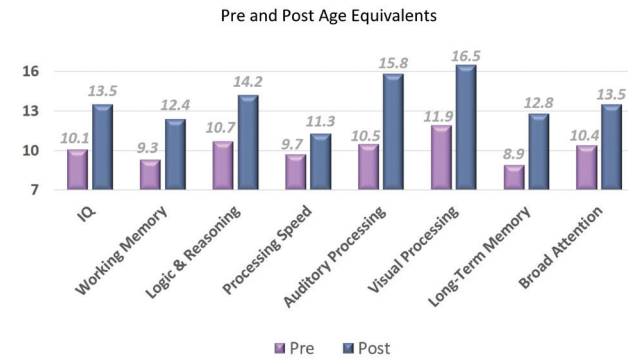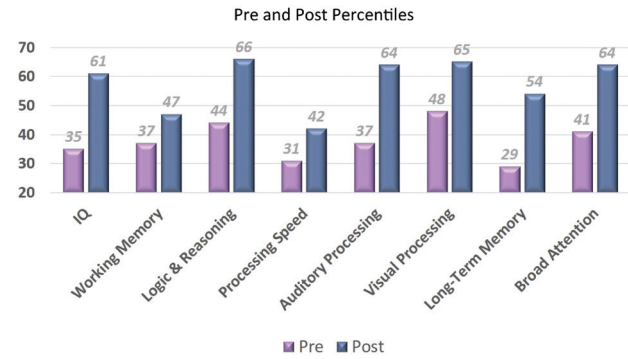
Dyslexia

Program: All

Number of Clients: 2,112

Mean Age: 11.9

Results: The following charts show the changes in cognitive skills for clients who came to LearningRx with a diagnosis of Dyslexia between 2010 and 2015. The changes in standard scores on the Woodcock Johnson III – Tests of Cognitive Abilities were statistically significant for all skills (p< .001) assessed. Overall, the largest gains were seen in auditory processing and long-term memory, followed by logic and reasoning and broad attention. The average pretest IQ score was 93 and the average post-test IQ score was 106. In addition, post-training percentiles are within the range of normal functioning, and the average age-equivalent gain in cognitive skill performance was 3.6 years.

Pre and Post Percentiles

Skill	Pre	Post
IQ	35	61
Working Memory	37	47
Logic & Reasoning	44	66
Processing Speed	31	42
Auditory Processing	37	64
Visual Processing	48	65
Long-Term Memory	29	54
Broad Attention	41	64

Pre and Post Age Equivalents

Skill	Pre	Post
IQ	10.1	13.5
Working Memory	9.3	12.4
Logic & Reasoning	10.7	14.2
Processing Speed	9.7	11.3
Auditory Processing	10.5	15.8
Visual Processing	11.9	16.5
Long-Term Memory	8.9	12.8
Broad Attention	10.4	13.5

Standard Score Change

Skill	Change
Long-Term Memory	14
Auditory Processing	14
IQ	13
Logic and Reasoning	12
Broad Attention	11
Working Memory	9
Visual Processing	8
Processing Speed	8

All changes are statistically significant (p < .001)

Reading Assessment Results by Client-Reported Diagnosis
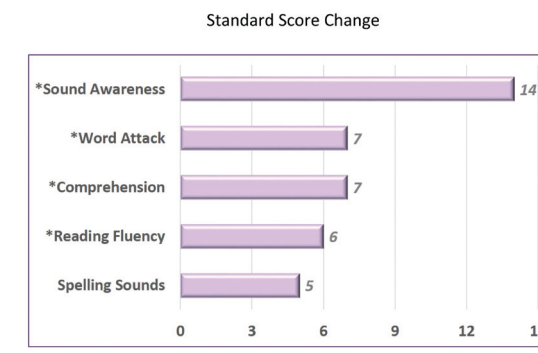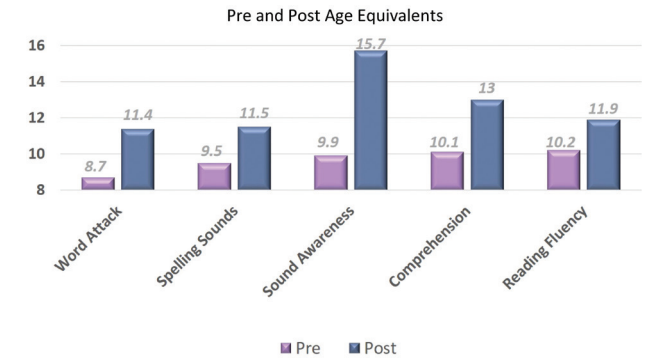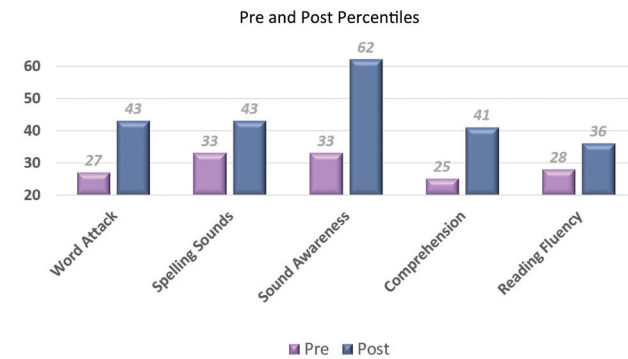
Dyslexia

Program: ReadRx

Number of Clients: 1,512

Mean Age: 11.8

Results: The following charts show the changes in reading skills for clients who came to LearningRx with a diagnosis of Dyslexia between 2010 and 2015. The changes in standard scores on the Woodcock Johnson III – Tests of Achievement were statistically significant for four of five skills (p < .001) assessed. Overall, the largest gains were seen in sound awareness, Word Attack, and comprehension followed by reading fluency and spelling. In addition, the average age-equivalent gain in reading skill performance was 3 years. In sound awareness—the primary skill needed for reading—the average age-equivalent gain was nearly 6 years.

Pre and Post Percentiles

Skill	Pre	Post
Word Attack	27	43
Spelling Sounds	33	43
Sound Awareness	33	62
Comprehension	25	41
Reading Fluency	28	36

Pre and Post Age Equivalents

Skill	Pre	Post
Word Attack	8.7	11.4
Spelling Sounds	9.5	11.5
Sound Awareness	9.9	15.7
Comprehension	10.1	13
Reading Fluency	10.2	11.9

Standard Score Change

Skill	Change
*Sound Awareness	14
*Word Attack	7
*Comprehension	7
*Reading Fluency	6
Spelling Sounds	5

*Changes are statistically significant (p < .001)

Cognitive Assessment Results by Client-Reported Diagnosis

Speech and Language Disorder

Program: All

Number of Clients: 1,854

Mean Age: 10.7

Results: The following charts show the changes in cognitive skills for clients who came to LearningRx with a diagnosis of Speech and Language Disorder between 2010 and 2015. The changes in standard scores on the Woodcock Johnson III – Tests of Cognitive Abilities were statistically significant for all skills (p< .001) assessed. Overall, the largest gains were seen in auditory processing and long-term memory, followed by logic and reasoning, working memory, and broad attention. The average pretest IQ score was 91 and the average post-test IQ score was 100. In addition, post-training percentiles are within the range of normal functioning, and the average age-equivalent gain in cognitive skill performance


Pre and Post Percentiles

Pre and Post Age Equivalents

Standard Score Change

All changes are statistically significant (p < .001)
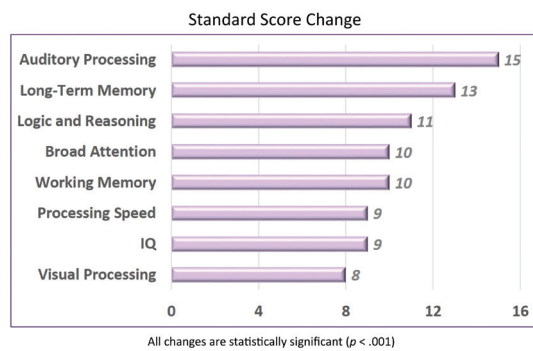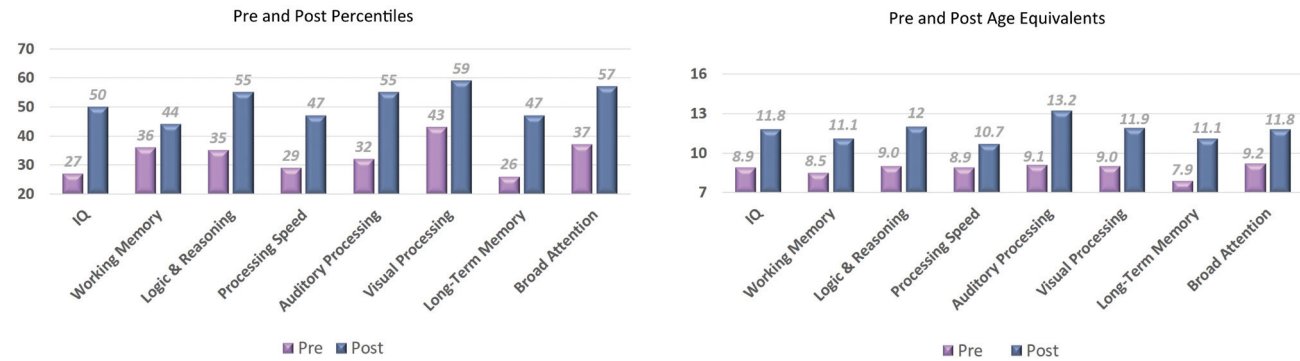
Cognitive Assessment Results by Client-Reported Diagnosis
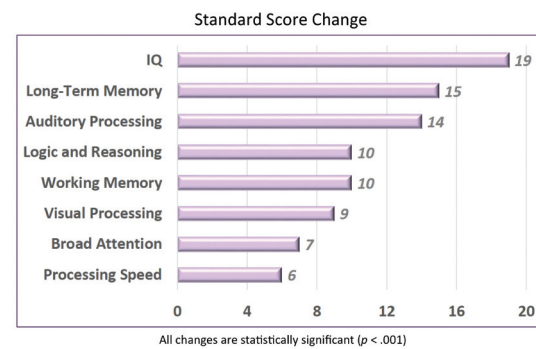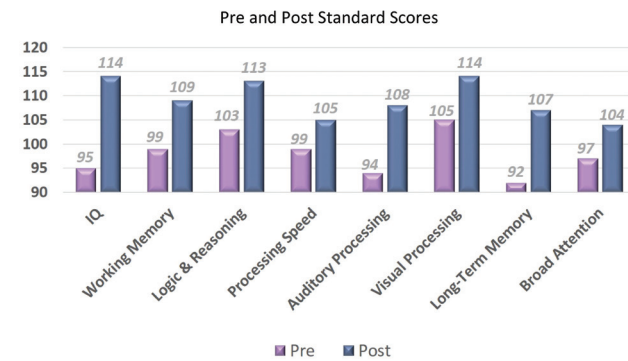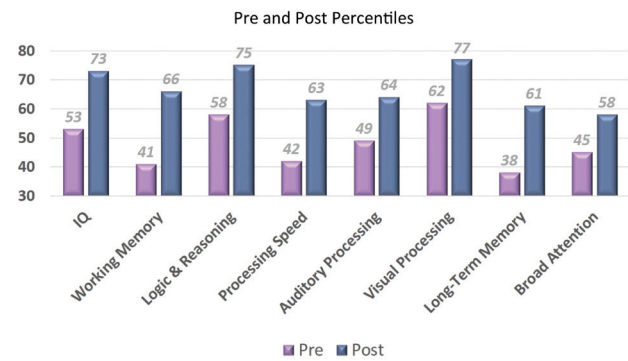
Autism Spectrum Disorder

Program: All

Number of Clients: 857

Mean Age: 11.9

Results: The following charts show the changes in cognitive skills for clients who came to LearningRx with a diagnosis of Autism Spectrum Disorder between 2010 and 2015. The changes in standard scores on the Woodcock Johnson III – Tests of Cognitive Abilities were statistically significant for all skills (p< .001) assessed. Overall, the largest gains were seen in auditory processing and long-term memory, followed by logic and reasoning, working memory, and broad attention. The average pretest IQ score was 92 and the average post-test IQ score was 101. In addition, post-training percentiles are within the range of normal functioning, and the average age-equivalent gain in cognitive skill performance was 3.1 years.

Pre and Post Percentiles

Pre and Post Age Equivalents

Standard Score Change

All changes are statistically significant (p < .001)
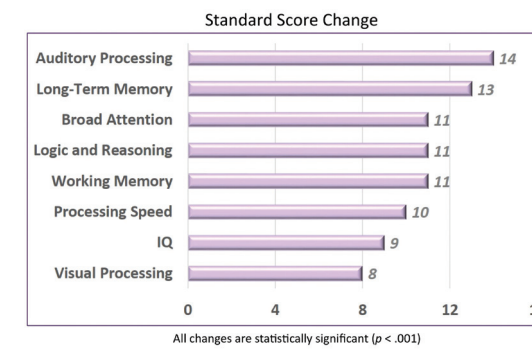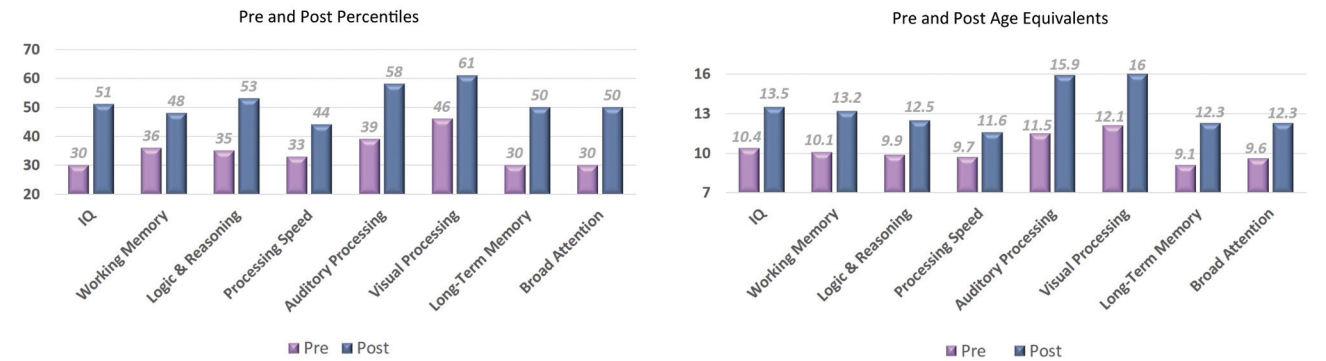
Cognitive Assessment Results by Client-Reported Diagnosis

Age-Related Memory Loss

Program:	All
Number of Clients:	262
Mean Age:	60.1

Results: The following charts show the changes in cognitive skills for clients over the age of 50 who came to LearningRx with a self-reported complaint of Age Related Memory Loss between 2010 and 2015. The changes in standard scores on the Woodcock Johnson III – Tests of Cognitive Abilities were statistically significant for all skills (p< .001) assessed. Overall, the largest gains were seen in IQ, auditory processing, and long-term memory, followed by logic and reasoning, working memory, and visual processing. The average pretest IQ score was 95 and the average post-test IQ score was 114. In addition, post-training percentiles are well within the range of normal functioning.
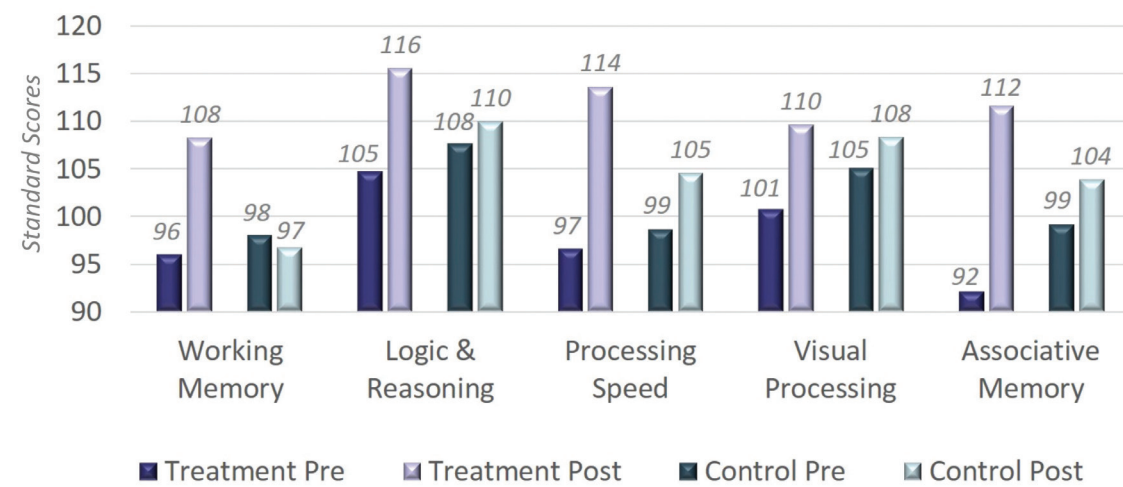
Pre and Post Percentiles

Skill	Pre	Post
IQ	53	73
Working Memory	41	66
Logic & Reasoning	58	75
Processing Speed	42	63
Auditory Processing	49	64
Visual Processing	62	77
Long-Term Memory	38	61
Broad Attention	45	58

■ Pre ■ Post

Pre and Post Standard Scores

Skill	Pre	Post
IQ	95	114
Working Memory	99	109
Logic & Reasoning	103	113
Processing Speed	99	105
Auditory Processing	94	108
Visual Processing	105	114
Long-Term Memory	92	107
Broad Attention	97	104

■ Pre ■ Post

Standard Score Change

Skill	Change
IQ	19
Long-Term Memory	15
Auditory Processing	14
Logic and Reasoning	10
Working Memory	10
Visual Processing	9
Broad Attention	7
Processing Speed	6

All changes are statistically significant (p < .001)

RESEARCH ABSTRACTS

Training the Brain to Learn: Beyond Vision Therapy

Abstract: The purpose of this study was to investigate the effectiveness of the ThinkRx cognitive training program. Sixty-one children (ages 6–18) were given pretest and post-test assessments using seven batteries from the Woodcock-Johnson III Tests of Cognitive Abilities and Tests of Achievement. Thirty-one of the students were enrolled in or had completed a 24-week cognitive training program in a Colorado Springs-based LearningRx center. A propensity matched control group of thirty students was selected from a group who had pretested but chosen not to enroll in the cognitive training program. Students who completed the ThinkRx cognitive training program realized greater gains than the control group on all measures. Statistically significant differences between groups were noted in six of the seven sets of scores (ps < .001). There were no significant differences based on age, gender, or learning disability.
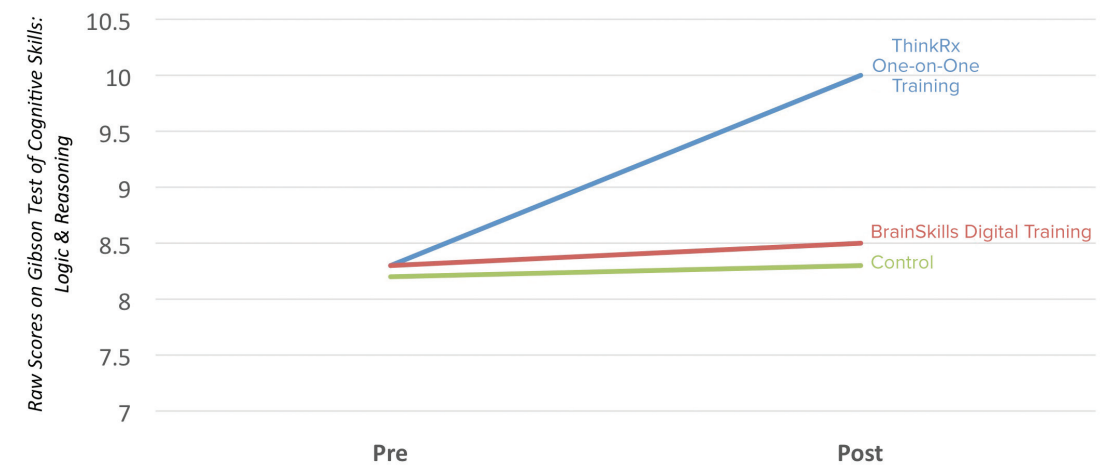
Multiple regression analyses indicated that treatment group membership was a statistically significant predictor of pretest to post-test score differences in associative memory (R^2= .445), logic and reasoning (R^2= .233), working memory (R^2= .265), processing speed (R^2= .409), auditory processing (R^2= .352), and Word Attack (R^2= .359). Completion of the cognitive training program was not a significant predictor of scores on visual processing.

The Efficacy of the LearningRx Cognitive Training Program: Modality and Transfer Effects

Abstract: This article reports two studies testing the efficacy of a one-on-one cognitive training program (ThinkRx) and its digital version (BrainSkills) in laboratory and school settings. Study 1 tested BrainSkills in a laboratory setting with 322 middle school students. Paired t-tests revealed significant gains on all cognitive measures and math performance after 3 weeks of training. Study 2, a randomized control study, included 225 high school students randomly assigned to one of three conditions: ThinkRx, BrainSkills, or study hall (control) in a school setting for a 15-week training period. Univariate ANCOVAs revealed significantly higher scores for the treatment groups compared with controls on working memory, logic and reasoning, and three of four math attitude measures but not for math performance. Because the intervention did not include the MathRx program, the results are as expected. (R^2= .352), and Word Attack (R^2= .359). Completion of the cognitive training program was not a significant predictor of scores on visual processing.

Reference: Gibson, K., Carpenter, D., Moore, A.L., & Mitchell, T. (2015). Training the Brain to Learn: Beyond Vision Therapy. Vision Development and Rehabilitation, 1(2), 119–128.

Reference: Hill, O.W., Zewelanji, S., & Faison, O. (2015). The Efficacy of the LearningRx Cognitive Training Program: Modality and TransferEffects. Journal of Experimental Education: Learning, Instruction, and Cognition, 1–21. doi: 10.1080/00220973.2015.1065218

Analysis of Resting State Functional Connectivity in a Cognitive Training Intervention Study

Abstract: As part of a larger randomized controlled study by Hill, Zewelanji, and Faison (2015), 30 of the 225 participating high school students were randomly assigned to one of three conditions: ThinkRx, BrainSkills, or study hall (control). In addition to pre and post cognitive testing these students underwent pre and post MRI imaging. Functional MRI was used to assess changes in resting state functional connectivity associated with cognitive training, and correlation of changes in functional connectivity to cognitive testing findings. Analysis of cognitive testing scores found that the cognitive training groups scored significantly higher than controls on multiple tasks, with the most significant gain occurring in auditory processing: auditory analysis segmenting (F=16.336, p=0.000) and auditory analysis drop (F=13.558, p=0.001). Analysis of resting state connectivity with the auditory cortex (superior temporal gyrus and right anterior temporal gyrus) revealed significant changes in the resting state connectivity with multiple cortical regions involved in cognitive processing (Figure 1). In addition, an increase in global network efficiency (network T=2.44, p-unc 0.02; PaCiG l : T=4.56, p-FDR=.01; MedFC: T=4.14, p-FDR=0.02; pITG l: T=-3.05, p-FDR=0.23; aSTG r: T=2.86, p-FDR=0.27) was found to occur following cognitive training (Figure 2). Further, analysis revealed that network changes correlated to auditory processing gains.

Figure 1. ROI to ROI Connectivity with a) Superior Temporal Gyrus b) Right Anterior Temporal Gyrus for Main Effect Cognitive Training > Controls Post Cognitive Training.
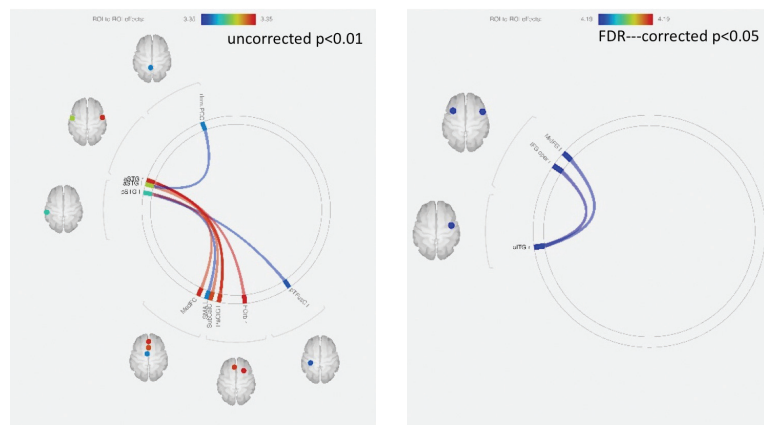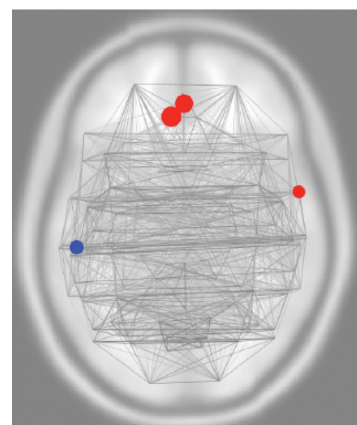
Figure 2. ROI-level Analysis of Global Efficiency Cognitive Training > Controls Post Cognitive Training

Reference: Ledbetter, C., Faison, M., Hill, O., & Patterson, J. (2016). *Analysis of Resting State Functional Connectivity in a Cognitive Training Intervention Study.* Poster presented at Center for Brain Health Annual Symposium: Reprogramming the Brain to Health: Computational Psychiatry and Neurology, University of Texas at Dallas, April 14, 2016.

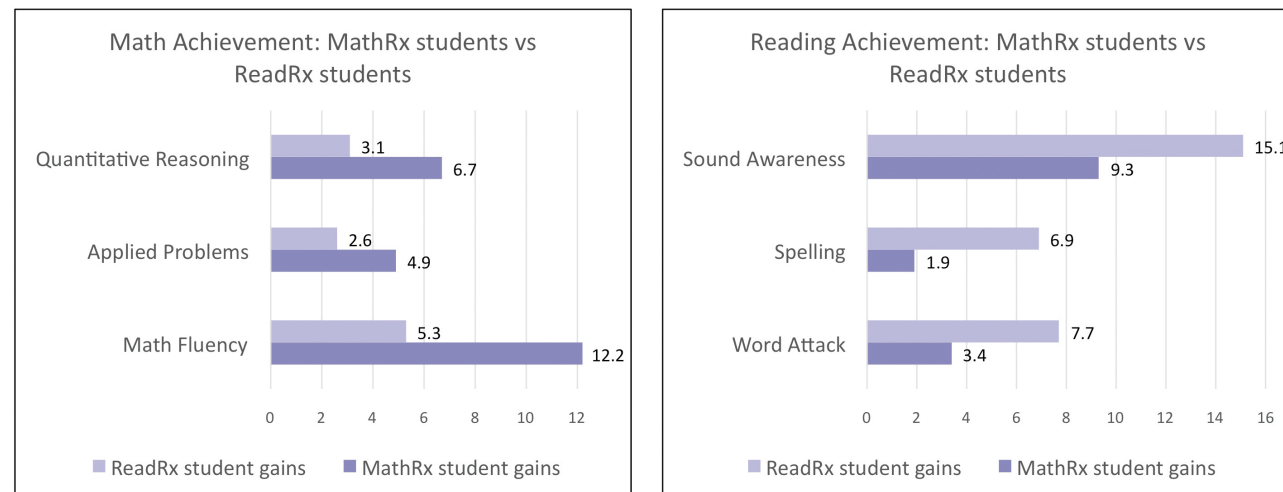# LearningRx Cognitive Training Effects in Children Ages 8–14: A Randomized Controlled Trial

Abstract: In a randomized controlled studywith students ages 8–14, we examined the effects of the ThinkRx cognitive training program on IQ, memory, visual and auditory processing, processing speed, and reasoning as measured by the Woodcock Johnson III − Tests of Achievement, and on attention as measured by the NIH Toolbox Cognitive Battery. Participants were randomly assigned to either an experimental group (n= 20) to complete 60 hours of cognitive training or to a wait-list control group (n= 19). The purpose of the study was to examine changes in general intelligence and individual cognitive skills after completing cognitive training with ThinkRx, a LearningRx program. Results showed statistically significant differences between groups on all outcome measures except for attention. (R^2= .352), and Word Attack (R^2= .359). Completion of the cognitive training program was not a significant predictor of scores on visual processing.

	CONTROL	TREATMENT	CASUAL EFFECT
	Pre-Post Difference	Pre-Post Difference	Treatment-Control
Logic and Reasoning	-7	21	**28**
IQ	-5	21	**26**
Long Term Memory	7	28	**21**
Working Memory	-8	13	**21**
Auditory Processing	-4	13	**17**
Associative Memory	8	23	**15**
Visual Processing	4	11	**7**
Processing Speed	7	13	**6**
Attention	3	5	**2**
Average Standard Score Gain	1	17	**16**

Reference: Carpenter, D., Ledbetter, C., & Moore, A.L. (2015). LearningRx Cognitive Training Effects in Children Ages 8–14: A Randomized Controlled Trial. Manuscript submitted for publication.

Achievement Outcomes for LearningRx Students: A Differential Effects Analysis of Math and Reading Achievement Before and After Cognitive Training

Abstract: To assess the outcomes of the ReadRx and MathRx programs for 2,096 students in 2008 to 2014, pre-intervention reading and math achievement scores were compared to post-intervention scores on the Woodcock Johnson III Tests of Achievement. To add a measure of control, we conducted a differential effects analysis of performance on achievement tests measuring the opposite skills from which the students were trained. MathRx students made nearly twice the gains in math than the ReadRx students, and ReadRx students made nearly twice the gains in reading as the MathRx students. The results indicate that the reading and math interventions are indeed targeting the skills they are intended to remediate.

Math Achievement: MathRx students vs ReadRx students

Category	ReadRx	MathRx
Quantitative Reasoning	3.1	6.7
Applied Problems	2.6	4.9
Math Fluency	5.3	12.2

■ ReadRx student gains ■ MathRx student gains

Reading Achievement: MathRx students vs ReadRx students

Category	ReadRx	MathRx
Sound Awareness	15.1	9.3
Spelling	6.9	1.9
Word Attack	7.7	3.4

■ ReadRx student gains ■ MathRx student gains

Reference: Moore, A. (2015). Achievement Outcomes for LearningRx Students: Math and Reading Achievement Before and After Cognitive Training. Colorado Springs, CO: Gibson Institute of Cognitive Research. (Full manuscript in preparation for publication.)

State Achievement Test Results for ReadRx Clients

Abstract: In 2010, LearningRx collected state reading achievement test records from 65 ReadRx graduates. Prior to training, the mean percentile for this group was 33. After training, the group had jumped to the 47th percentile in reading—nearly average for their age. Further, 91% of students who completed the ReadRx program (59 of 65) showed improvement on state reading achievement tests after the intervention.
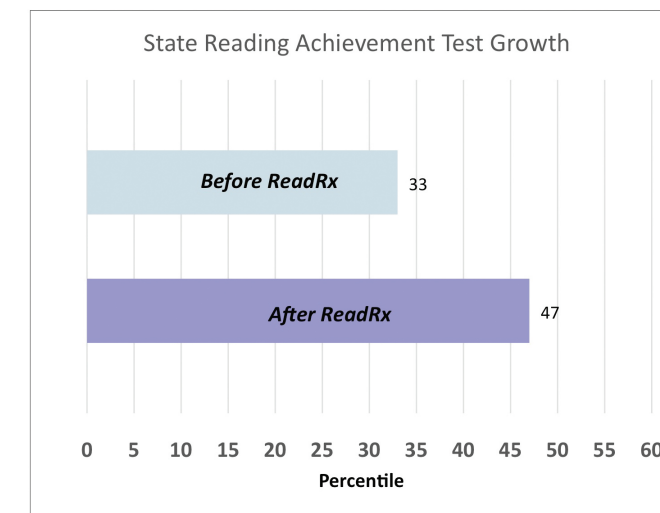
State Reading Achievement Test Growth

	Percentile
Before ReadRx	33
After ReadRx	47

Percentile

Reference: Moore, A. (2015). Achievement Outcomes for LearningRx Students: Math and Reading Achievement Before and After Cognitive Training. Colorado Springs, CO: Gibson Institute of Cognitive Research. (Full manuscript in preparation for publication.)
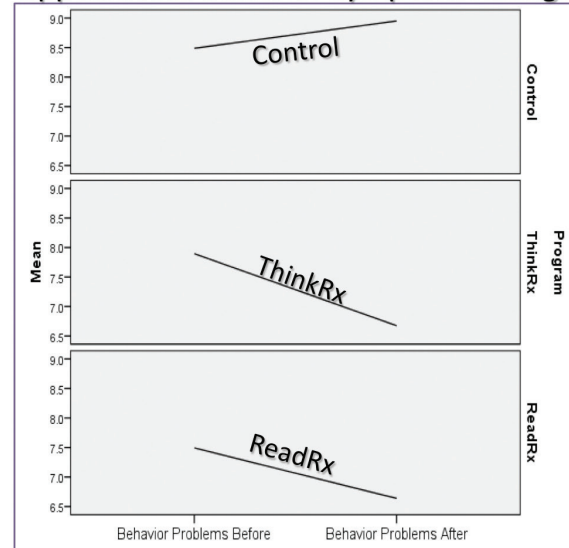
Real Life Benefits of LearningRx Cognitive Training: A Controlled Study

Abstract: This study investigated whether a one-on-one cognitive training program reduced academic difficulties and oppositional behavior for 226 school-age children. Using a standardized parent rating scale, Learning Skills Rating Scale (LSRS), three groups were surveyed: Seventy-seven students who had completed the 60-hour ThinkRx cognitive training program, sixty-nine students who had completed the 120-hour ReadRx cognitive training program, and eighty students who completed initial testing but chose not to complete a training program. Results indicated there were statistically significant differences between the treatment groups and the control group on all measures of academic difficulties. Both treatment groups saw a reduction in academic difficulty ratings following training while the control group saw an increase in academic difficulty during a comparable time interval. Further, both treatment groups improved on ratings of oppositional behavior while the control group ratings worsened.


Academic Difficulty Symptom Ratings
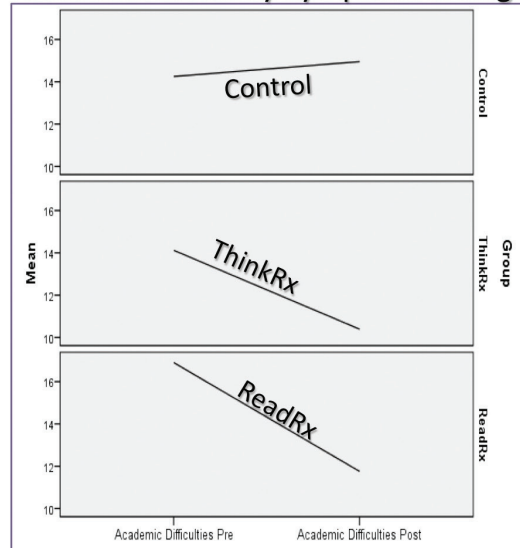
Oppositional Behavior Symptom Ratings

Reference: Jedlicka, E. (2015). Real Life Benefits of LearningRx Cognitive Training: A Controlled Study. Based on 2012 dissertation; manuscript submitted for publication.

LearningRx Training and IQ Gains: Multiple Baseline Study

Abstract: For this study, we used multiple IQ baselines to allow students to serve as their own controls. We collected diagnostic test results of 40 students to establish their baseline IQ. These tests were given by independent psychologists within 18 months prior to initial contact with LearningRx. Comparing the diagnostic IQ score to the LearningRx pretest score, we saw a slight decline in IQ from an average of 102 to an average of 96 during the time students waited to begin training at LearningRx. Thus, it is apparent they were not spontaneously improving after their initial diagnosis; in fact they were getting worse. However, this changed after treatment. From LearningRx pretest to post-test, they not only regained the ground they had lost previously, but had also made significant improvements. The average IQ after training had increased to 112—a gain of 16 points.
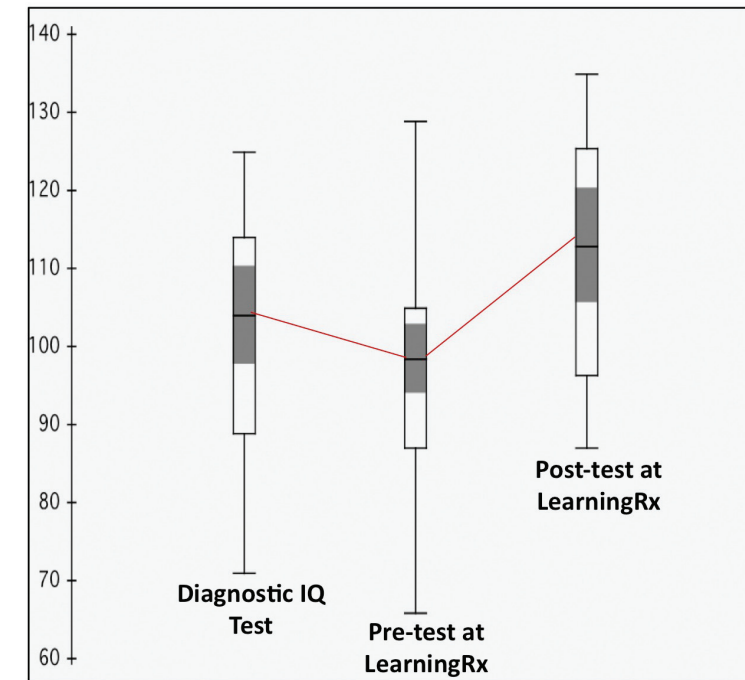

Reference: Moore, A.L. (2015). LearningRx Training and IQ Gains. Colorado Springs, CO: Gibson Institute of Cognitive Research

A feasibility study of one-on-one cognitive training with supplemental digital delivery for soldiers with traumatic brain injury

Abstract: In this quasi-experimental, pretest-posttest feasibility study, 11 soldiers between 3 and 36 months post traumatic brain injury completed half of ThinkRx through one-on-one cognitive training at an occupational therapy clinic and half through computer-based cognitive training sessions at home. Participants achieved statistically significant gains in short term memory, associative memory, executive processing, auditory processing, and fluid reasoning with very large effect sizes; and self-reported improvements in attention, memory, and organization. Further, they achieved significant clinical changes, restoring function to normal levels in nearly all cognitive skills. Examples of clinically significant changes in memory are shown in the box plots.

Pre and Post Standard Scores on Woodcock-Johnson III Tests of Cognitive Abilities
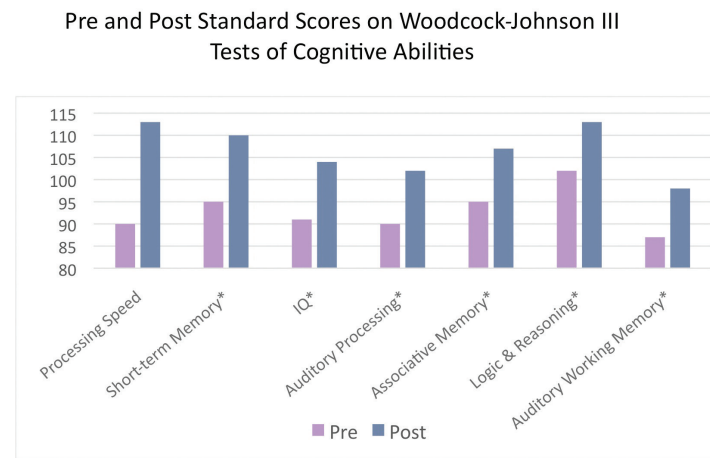
*change significant at $p < .005$
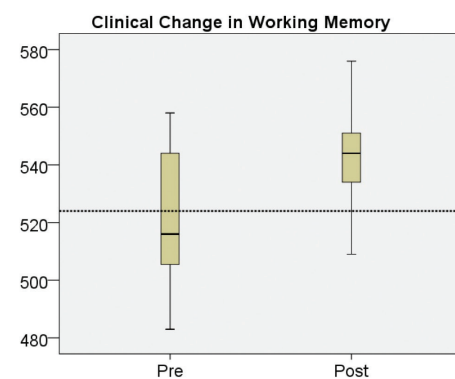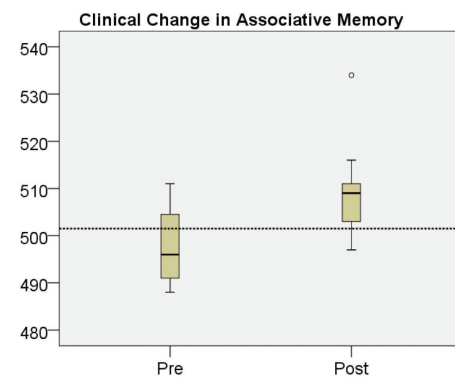
Clinical Change in Associative Memory

Clinical Change in Working Memory

Reference: Ledbetter, C., Moore, A. L. , & Mitchell, T. (2016). A feasibility study of one-on-one cognitive training with supplemental digital delivery for soldiers with traumatic brain injury. Manuscript submitted for publication.

A Feasibility Study of One-on-One Cognitive Training with Supplemental Digital Delivery for Soldiers with Traumatic Brain Injury: Functional Results

Abstract: As part of the quasi-experimental, pretest-posttest feasibility study with 11 soldiers between 3 and 36 months post traumatic brain injury, researchers collected personal pre-intervention goals from each participant. At the completion of the study, researchers collected self-reported improvements from each participant. The results reveal a variety of improvements beyond the initial training goals.

Pre-Intervention Goals	Post-Intervention Improvements
Improve memory	• Increased memory for daily tasks • Remember appointments without reminders • Remembers conversations
Improve concentration, focus, and attention	• Increased attention span • Increased time on task • Organized and focused • Focused longer
Improve processing speed	• Finds information more quickly
Improve reading, writing, and communication	• Improved language skills • Can complete job applications
Improve math skills	• Increased confidence for math • Can manage bills
Learn and retain information	• Can return to school • Interested in learning
Multi-task & work under pressure	• Works harder at challenging tasks • Makes and sticks to plans • Higher tolerance for frustration

EXIT INTERVIEW COMMENTS FROM TWO PARTICIPANTS:

"This program was a bright light in a dark space."
"This was the most helpful thing I have experienced in my life."

Reference: Ledbetter, C., Moore, A. L. , & Mitchell, T. (2016). A feasibility study of one-on-one cognitive training with supplemental digital delivery for soldiers with traumatic brain injury. Full manuscript in preparation.

Mixed Methods Study on LearningRx Results for Students with Dyslexia

Abstract: To assess the real-life changes following training, we surveyed parents of former clients who had been previously diagnosed with dyslexia and later completed a LearningRx training program. The survey results from the 109 respondents indicatedthat a large percentage of clients saw classroom improvements such as faster reading, reading comprehension, and memory for details. Almost 50% reported achieving better grades after training, and more than 50% reported increased confidence for school. Clients also reported more positive relationships with others, more independence in completing homework, and increased participation and performance in sports.

SOCIAL/RECREATIONAL IMPROVEMENTS	
Answer Options	Response
More positive relationships with family	48%
More positive relationships with teachers	47%
More positive relationships with friends	43%
Increased confidence in extra-curricular activities	34%
Increased participation in extra-curricular activities	28%
Increased confidence about playing sports	26%
Increased participation in sports	18%
Better performance in extra-curricular activities	16%
Better performance in sports	15%

SCHOOL-RELATED IMPROVEMENTS	
Answer Options	Response
Reads faster	59%
Completes homework more independently	56%
Is more confident about school	55%
Remembers details from reading	53%
Understands what is read	52%
Achieves better grades	46%
Completes homework faster	45%
Has a better memory	40%
Solves math problems more quickly	39%
Pays attention longer	38%
Is more organized	34%
Is eager to read	33%
Is more focused	33.%
Achieves higher standardized test scores	30%
Finishes classwork on time	29%

Reference: Ledbetter, C., Moore, A. L. , & Mitchell, T. (2016). Mixed Methods Study on LearningRx Results for Students with Dyslexia. Technical report in preparation.

One-Year Retention Results for LearningRx Clients

Abstract: To assess retention of training gains for LearningRx clients, we analyzed the results for 516 clients who opted to return for a one-year follow-up assessment on the Woodcock Johnson III – Tests of Cognitive Abilities. The average age of clients who completed the follow-up testing was 10.8. Retention rates ranged from 96% to 99%, with the greatest retention of skills in visual processing, auditory processing, and logic and reasoning.

PRE, POST, AND FOLLOW-UP STANDARD SCORES				
Skill	Pre	Post	One-Year Later	Retention
IQ	95	111	107	97%
Long-Term Memory	94	107	106	98%
Visual Processing	102	109	108	99%
Auditory Processing	111	122	121	99%
Logic & Reasoning	100	111	111	99%
Processing Speed	91	99	94	96%
Working Memory	94	104	101	98%

All scores are rounded to the nearest whole number

Client Satisfaction Ratings

Abstract: To assess client satisfaction with LearningRx training programs, parents and adult clients complete an exit survey at the end of training. From 2005-2015, over 19,000 of our 21,836 clients rated the training a 9 or a 10. 71% rated LearningRx a 10, and another 24% rated LearningRx an 8 or a 9. And in 2015, the average score across all LearningRx centers was a 9.6 out of 10!

EXIT INTERVIEW RATINGS				
Question	10	9 or 8	7 or below	Average Rating
On a scale of 1 to 10, how likely would you be to refer a friend or family member to LearningRx?	71%	24%	5%	9.6

Reference: Cameron, K. & Moore, A.L. (2014). 2014 Report of LearningRx Training Results. Colorado Springs, CO: LearningRx. Available at LearningRx.com

LearningRx Research

Carpenter, D., Ledbetter, C., & Moore, A. (2015). *LearningRx cognitive training effects in children ages 8–14: A randomized controlled study.* Manuscript submitted. Summary of results available at http://downloads.learningrx.com/2015-RCT-Study-Results.pdf

Gibson, K., Carpenter, D.M., Moore, A.L., & Mitchell, T. (2015). Training the brain to learn: Beyond vision therapy. *Vision Development and Rehabilitation, 1*(2), 120–129. Retrieved from http://www.covd.org/?page=VDR

Hill, O.W., Zewelanji, S., & Faison, O. (2015). The Efficacy of the LearningRx Cognitive Training Program: Modality and Transfer Effects. *Journal of Experimental Education: Learning, Instruction, and Cognition.* doi: 10.1080/00220973.2015.1065218. Available at http://dx.doi.org/10.1080/00220973.2015.1065218

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