

**Research Report:
Arrowsmith Symbol Relations
Cognitive Program Outcomes
Teen Challenge Tasmania Program**

February 2023

Overview

In February 2022, a project was started in collaboration with Teen Challenge, Tasmania, and the Arrowsmith Program. The hypothesis was that the Arrowsmith Symbol Relations Cognitive Program would be of benefit cognitively and academically to the group of school-aged students at Teen Challenge in Tasmania. This population of children have had significant negative impact on their cognition related to trauma, prenatal issues, childhood experiences and substance abuse.

Arrowsmith Symbol Relations Cognitive Program

The Arrowsmith Symbol Relations Task is a computer-based cognitive exercise consisting of a sustained visual-spatial processing task of progressively increasing difficulty. It requires students to use relational reasoning to conceptually and automatically process relationships that increase in complexity. Over the years, many research projects have been conducted with various cohorts of individuals, from those with learning difficulties/disabilities, traumatic brain injury, long COVID and those without learning challenges wishing to enhance performance.

The Symbol Relations cognitive function is involved in:

- cause and effect reasoning
- understanding the 'why' of things
- grasping concepts across all academic disciplines
- comprehension of what is read or heard
- making rational and considered decisions
- understanding the world, oneself, and others
- fluid reasoning and flexibility of thought
- logical grasp of mathematical concepts
- processing speed
- insight which is critical to the therapeutic process
- semantic grasp of language necessary for comprehension and vocabulary development
- perspective taking which involves the ability to consider other points of view necessary for empathy

If there is a difficulty in this cognitive function all of these processes are impacted. Research on the Symbol Relations program outcomes for individuals with learning difficulties or learning disabilities has demonstrated significant improvements in:

- neural networks in the brain
- cognitive functioning
- acquisition of academic skills
- emotional intelligence and well-being

Research Method

For the 2022 study, data was collected over 8 months in 2022 on:

- cognitive abilities on the Woodcock-Johnson IV Tests of Cognitive Abilities
- academic achievement on the Woodcock-Johnson IV Tests of Achievement
- a survey questionnaire of observed changes across a range of dimensions related to the Symbol Relations cognitive function

Group

There were 8 participants, comprised of 3 males and 5 females, with an average age of 13.1 and ranging in age from 8 to 20 years old. They worked on the Symbol Relations cognitive program four hours per week over 8 months. This population of children have had significant negative impact on their cognition related to trauma, prenatal issues, childhood experiences and substance abuse.

For information on the research measures used, See Appendix A: Research Measures Used.

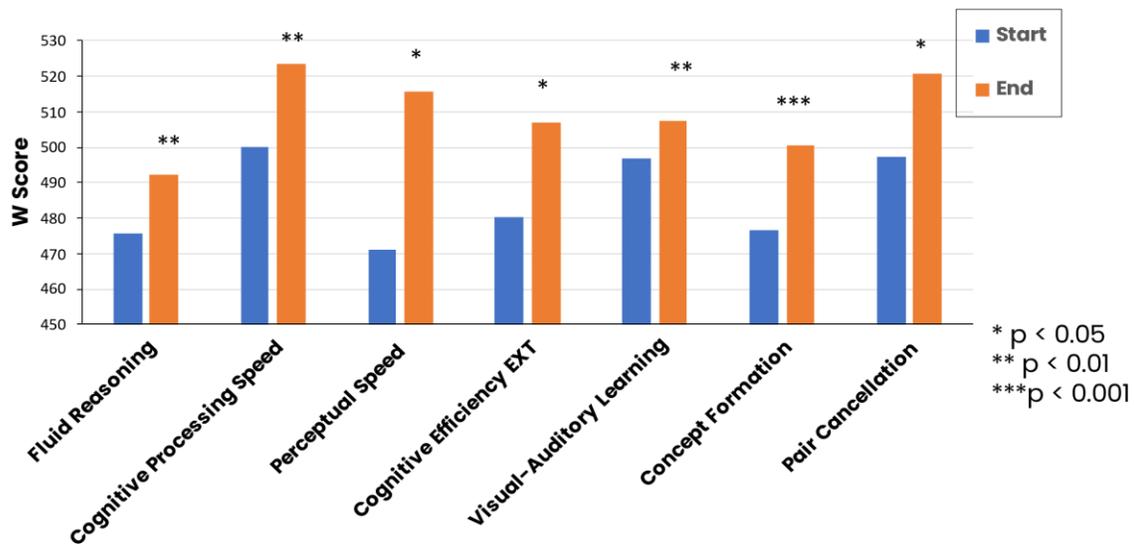
Results

Woodcock-Johnson IV Tests of Cognitive Abilities Test Results

The Woodcock-Johnson IV Tests of Cognitive Abilities is an individually administered, norm-referenced instrument that measures specific cognitive abilities in persons aged 2 to 90.

Over 8 months of working on the Symbol Relations cognitive function, participants showed statistically significant gains on a standardized measure (Woodcock-Johnson IV Test of Cognitive Abilities) of the following cognitive abilities:

Woodcock-Johnson IV—Significant Findings Cognitive Abilities Improvements 2022 Data



Fluid Reasoning – measures broad ability to reason, form concepts, and solve problems using unfamiliar information or novel procedures.

Cognitive Processing Speed – measures the ability to quickly perform both simple and complex cognitive tasks, particularly when under pressure to sustain controlled attention and concentration.

Perceptual Speed – measures the ability to rapidly identify matching items.

Cognitive Efficiency – measures the ability to cognitively process information automatically which frees up working memory.

Visual Auditory Learning – measures long-term storage and retrieval. (spelling) patterns.

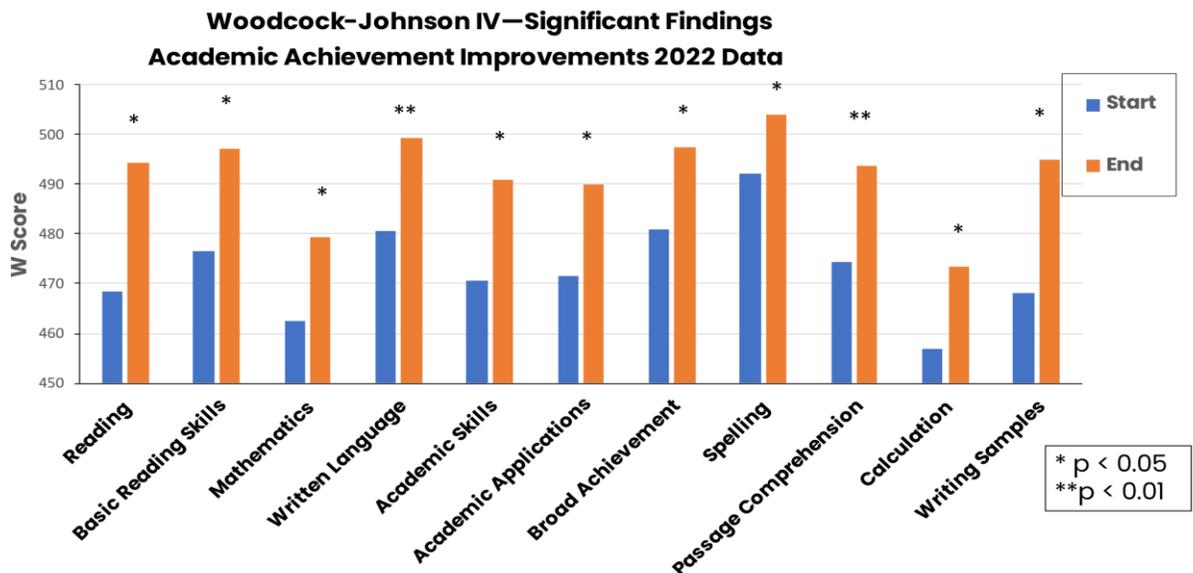
Concept Formation – measures categorical reasoning based on principles of inductive logic.

Pair Cancellation – measures interference and inhibition control (executive processing) and sustained attention (attention/ concentration).

Woodcock-Johnson IV Achievement Test Results

The Woodcock-Johnson IV Test of Achievement is an individually administered, norm-referenced instrument that measures specific areas of academic achievement in persons aged 4 to 90.

Over 8 months of working on the Symbol Relations cognitive function, participants showed statistically significant gains on a standardized measure (Woodcock-Johnson IV Test of Achievement) of the following areas of academic achievement:



Reading – word identification, reading speed, comprehension

Reading Skills– word identification and word attack (phonetics)

Mathematics – applied math problems and calculation

Written Language – spelling and writing samples

Academic Skills – word identification, spelling, calculation

Academic Applications – applied math problems, comprehension, writing Samples

Broad Achievement – word identification, word attack, applied math problems, calculation, comprehension, writing samples, spelling, sentence reading fluency, math facts fluency, sentence writing fluency

Spelling – spelling

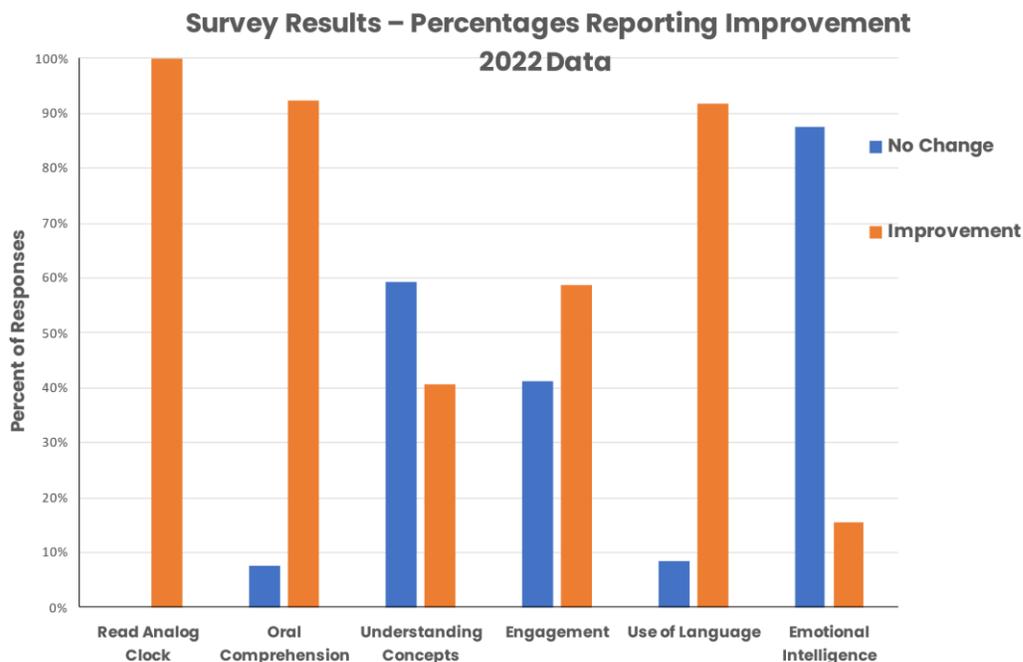
Passage Comprehension – reading comprehension

Calculation – math computation

Writing Samples – writing samples based on a verbal or picture cue

Parent/Guardian Survey Questionnaire Results

Three to six months after completion of the Symbol Relations cognitive program, parents and/or guardians reported significant improvement on several behaviours which correspond to the changes noted above in cognitive abilities. These behaviours were grouped on analysis into the categories, the following of which showed significant improvement.



Oral Comprehension – able to grasp more quickly and accurately what is heard

Engagement – greater focus, attention, and mental initiative

Use of Language – improved vocabulary and communication skills

Parents/Guardians on the Survey reported:

- Now asks in depth questions
- Vocabulary is much better
- More able to understand and comprehend during a conversation
- Better able to argue a point in a clear and thoughtful way
- School is reporting better behaviour
- Better learning outcomes at school and more settled in class
- Teachers report learning is getting better
- Improved understanding of the work in class
- Changes seen in English, Mathematics, Written Expression
- Spelling is better and essays make more sense
- Now enjoying schoolwork and learning new things
- Getting better grades
- Finds schoolwork easier and requires less help
- More eager and motivated to learn
- Getting work done on time and getting good grades
- Becoming confident to go places without me
- Thinking and strategies have improved
- More settled and able to regulate quicker in most situations

Areas of reported concern were behavioural challenges related to previous trauma:

- Still struggles with confidence, but this is trauma based.
- Trauma based behaviour that is extremely challenging.
- Behaviour is trauma based.

Comparison of Results to Previous Research on Symbol Relations Outcomes

The significant changes for the school-aged students in this study on the measures of the Woodcock-Johnson Cognitive Abilities and Academic Achievement measures, and the self-report on the survey are consistent with other research conducted on the Symbol Relations cognitive program and students with learning difficulties.

See: [Arrowsmith Research](#)

Conclusion

The Symbol Relations cognitive program is an effective adjunct to the educational program for this population of students who have had significant negative impact on their cognition correlated to trauma, prenatal issues, childhood experiences and substance abuse. The Arrowsmith Symbol Relations cognitive program fostered significant cognitive and academic gains essential for learning, school success and social-emotional well-being. The cognitive gains translated into significant academic achievement gains.

Research Organizations

The **Arrowsmith Program** is an organization that has developed a suite of cognitive programs that harnesses the principles of neuroplasticity through the application of targeted cognitive exercises to overcome specific cognitive difficulties. The Symbol Relations exercise, administered in this study, assists in laying a foundation so that the individual can understand, absorb, retain, and process information and make cause/effect connections necessary for insight. Some outcome examples include improved reasoning, comprehension, insight, thinking, planning, cognitive flexibility, and ability to regulate emotions. The Arrowsmith Program has helped thousands of people over the last 40+ years by using the principles of neuroplasticity to strengthen cognitive functions related to regions and networks of regions of the brain.

Teen Challenge Tasmania is a not-for-profit organisation, established in 2014 to provide early intervention for at-risk youth to avoid or turn away from the path of substance use and addiction. Teen Challenge Tasmania provides mentoring within local Primary and High Schools, deliver Alcohol and other Drug Education within schools and communities nationally in Australia and even internationally, to date speaking to over 93,000 young people on the impacts of substance use to the developing brain and their future potential. Art Therapy groups are provided for young people struggling with mental health challenges. They believe to build resilience young people need connection, encouragement and empowerment; therefore we provide mentoring, workplace training and employment within our social enterprises a Hope Costume & Thrift Store and Hope Cafe Tasmania. The impact of substance abuse in communities is both significant and complex, causing an increase in homelessness, criminal activity, mental health issues and family breakdown. Addiction is closely intertwined with cognition, with multiple factors such as drug effects, withdrawal effects and probability of relapse - linked with cognitive capacity.

Data Analysis

The data analysis was done by Dr. Greg Rose, Professor Emeritus, Southern Illinois University.

Appendix A: Research Measures Used

Survey Questionnaire

A questionnaire is completed by parents using a five-point rating scale to report on behaviours related to the Symbol Relation cognitive function. These behaviours are grouped into the following categories: oral comprehension; understanding concepts; engagement; emotional intelligence; and school performance.

[Woodcock-Johnson IV Tests of Cognitive Abilities and Achievement](#)