

# Effects of the Arrowsmith Program on Academic Performance: A Pilot Study

Hanna A. Kubas, Jessica A. Carmichael, Kim R. Fitzer, James B. Hale  
University of Calgary

## Abstract

The Arrowsmith Program (AP) is a cognitive-based intervention program designed to remediate processing weaknesses in children with specific learning disabilities (SLD) by providing targeted interventions that strengthen the specific underlying processing deficit presumably causing the SLD. Pre- and post-intervention WJ-III achievement data was collected on 15 students in the AP program. NPStat non-parametric randomization tests revealed single-subject improvements across all academic variables, and paired sample *t*-tests revealed differences between pre- and post-testing for most academic domains. Results suggest that targeting underlying processing weaknesses in SLD can impact real world outcomes such as academic achievement.

## Introduction

- The AP consists of a program of intensive and graduated cognitive exercises designed to strengthen cognitive weakness(es) that are presumed to contribute to SLD
- The AP is based on neuroscience research regarding brain plasticity that suggests it is possible to strengthen weaker cognitive functions that underlie learning challenges through a program of targeted and graduated cognitive exercises
- AP research and practice has identified 19 specific learning dysfunctions that vary across individuals with SLD, including those that affect both posterior and anterior brain functions
- Recent case study research conducted on the AP suggests that most participants experienced significant increases in cognitive, academic, emotional and/or interpersonal functioning<sup>1</sup>
- Targeting processing weaknesses instead of achievement deficits is controversial<sup>2</sup> and has not received sufficient empirical support<sup>3</sup>, thus further investigation is necessary

## Research Questions



- Does targeting and strengthening cognitive deficits impact academic achievement across reading, mathematics, writing, and language domains?
- Does the AP graduated targeted intervention approach result in improved academic performance at the single subject and group level of analyses?

## Method

- Woodcock Johnson III Achievement* data was collected for 15 students (11 male, 4 female; *M* age = 9.3 years; *SD* = 1.36 years) of average intelligence prior to AP entry and again following intervention implementation (*M* time between testing = 28 months; *SD* = 8.36 months)
- Individual treatment response was assessed using a non-parametric randomization test (NPStat)<sup>4</sup> which approximates multivariate analyses in the absence of normal data
- Paired samples *t*-tests were used to compare pre-post group means

## Discussion

- At baseline entry into the AP, children with SLD mostly had low average WJ-III ACH, with math and writing fluency in the borderline range
- Following AP intervention, all academic scores improved and were in the average range except for math fluency
- Strengthening cognitive/neuropsychological functions presumed to underlie academic achievement deficits improves reading, mathematics, and writing by targeting the cause (i.e., cognitive deficit) rather than the symptoms (i.e., achievement deficit)
- Targeted interventions based on knowledge of brain plasticity can lead to improved short-term academic performance across a broad range of domains

## Results

Table 1  
Pre-Post Differences on WJ-III Achievement Variables

Cluster	Subtest		Mean	<i>t</i>	<i>p</i>
Reading	Letter Word Identification	Pre	87.80	5.57	< .001
		Post	98.33		
	Reading Fluency	Pre	81.50	8.48	< .001
		Post	90.14		
Mathematics	Passage Comprehension	Pre	85.53	8.85	< .001
		Post	96.20		
	Word Attack	Pre	88.53	5.21	< .001
		Post	101.93		
Writing	Calculation	Pre	82.47	11.69	< .001
		Post	94.13		
	Math Fluency	Pre	72.47	6.61	< .001
		Post	84.07		
Receptive Language	Quantitative Concepts	Pre	87.60	6.20	< .001
		Post	101.27		
	Spelling	Pre	81.93	5.40	< .001
		Post	91.00		
Future Directions	Writing Fluency	Pre	74.85	8.15	< .001
		Post	94.69		
	Writing Samples	Pre	84.73	7.48	< .001
		Post	100.80		
References	Understanding Directions	Pre	93.07	4.62	< .001
		Post	98.20		

- Inspection of individual response curves and NPStat nonparametric randomization test results revealed significant single-subject treatment response across all WJ-III achievement variables (*F* range 24.83 to 128.96; *p* < .001)
- Paired samples *t*-tests (alpha set at .001 to guard against Type I error) revealed improvements in broad reading and writing areas, receptive language, and most math areas (*t* range 4.62 to 11.69; *p* < .001)
- In contrast, no significant differences emerged between pre and post results for Story Recall, Applied Problems, Spelling of Sounds, and Sound Awareness



## Future Directions

- Research is needed to determine how strengthening cognitive deficits translates into real-world classroom achievement and long-term academic gains
- Future research with larger sample sizes, neuroimaging and neuropsychological data, and different SLD subtypes is also needed
- Cognitive interventions based on individual processing domains (e.g., auditory processing, fluid reasoning, processing speed) could determine if the treatment effects are general or specific in action

## References

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