



# Impact of Computer-Based Cognitive Training on Elementary Students' Reading Skills

## Background

Beginning in December of the 2017-18 school year, the Whycomomagh Education Centre in Orangedale, Nova Scotia (Strait Regional School Board), under the direction of Literacy Mentor Dr. Betsy Jardine and Classroom Teacher Kimberly Gillis, implemented BrainWare SAFARI cognitive skills training software with Mrs. Gillis's 4<sup>th</sup> and 5<sup>th</sup>-grade students.

Dr. Jardine and Mrs. Gillis administered two types of tests before and after the students used BrainWare so they could see the impact on their students' performance on relevant academic measures. The tests included three Woodcock-Johnson Academic Tests: Sentence Fluency, Word Fluency and Math Fluency. The second type of test was the Fountas and Pinnell grade-level reading test.

A total of 20 students, 15 5<sup>th</sup>-graders and 5 4<sup>th</sup>-graders were pre- and post-tested with the Fountas and Pinnell. Woodcock Johnson fluency test data are available for 18 students.

While BrainWare SAFARI does not teach or train reading or math or any subject matter directly, it develops underlying cognitive skills that are necessary for learning to read, do math, and solve problems, across the curriculum.

## BrainWare SAFARI Usage

The recommended protocol for using BrainWare SAFARI is 3 to 5 times per week, for 30 to 45 minutes per session, for at least 12 weeks. The Whycomomagh Education Centre staff implemented the program diligently, making sure that the students used the program as recommended, both in terms of sessions and duration but also ensuring that they moved around among the different exercises in the program. The students used BrainWare SAFARI for approximately 12 weeks, on average exceeding the goal of using the program 3 times per week (3.4 sessions per week, on average).

	Minimum	Average	Maximum
Sessions Completed	27	41	48
Levels Completed	72	120	160

## Woodcock-Johnson Academic Score Results

The three WCJ tests were scored on the basis of grade equivalency. Since a student is expected to gain one grade equivalent per school year, the expected gain over 12 weeks would be 0.3 GE (0.4 GE looking at total elapsed time, including vacation time). On each test, the average improvement dramatically exceeded the expected gain, as shown in Figure 1.

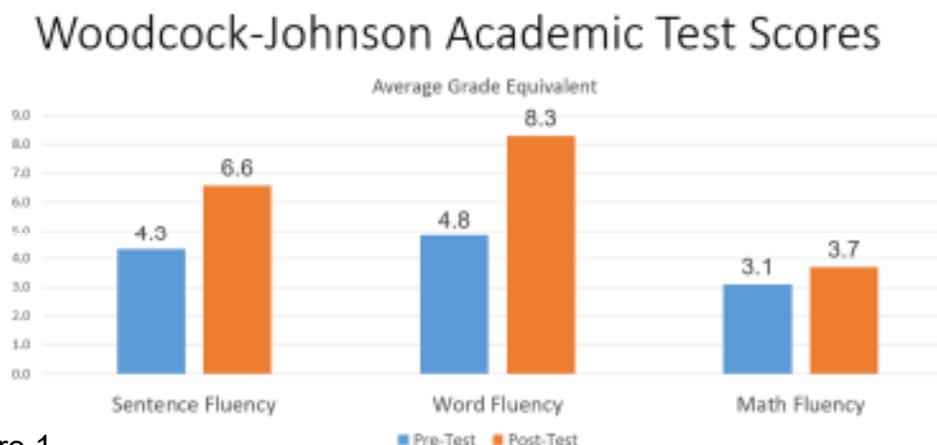


Figure 1

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The average score for these students on the Sentence Fluency test increased by 2.3 GE (over 5 times the expected gain). The average score on the Word Fluency test increased by 3.5 GE (over 11 times the expected gain). The average score on the Math Fluency test increased by 0.6 (almost twice the expected gain).

## Fountas and Pinnell Reading Level Results

The Fountas and Pinnell Reading system provides texts at various levels of reading development, designated from A through Z. 4<sup>th</sup> and 5<sup>th</sup>-grade students who are reading at levels O through V are considered to be reading at their grade level. The system requires an accuracy rate of at least 97% for a student to be considered proficient at that level. Students are expected to gain 5 reading levels over the course of the year, so the expected gain over the span of the students' use of BrainWare SAFAR would be 1.5 grade levels.

Students took Fountas and Pinnell reading test multiple times over the course of the school year, and the reading level of the student was identified each time. In looking at overall growth, the analysis looked at the number of reading levels of improvement from the test prior to starting to use BrainWare SAFARI to the test taken immediately after their usage had been completed.

Of the 20 students, only two did not gain additional reading levels and that was because they were already performing at the highest reading level (Z). Of the 18 students who were not already performing at reading level Z, all improved at least one reading level during this time frame. The average improvement for this group of students was 4.1 GE (4.5 excluding the two students who were already at the highest reading level), substantially more than the growth expectation for this period of time. Figure 2 below show the number of reading levels of improvement experienced by this group of students. Two-thirds of the students who used BrainWare improved their reading proficiency by at least 4 grade levels, and one student gained 10 grade levels.

Number of Reading Levels of Growth	Number of Students Gaining at Least that Many Reading Levels	Percentage of Students Gaining at Least that Many Reading Levels
1	18	100%
2	17	94%
3	15	83%
4	12	67%
5	7	39%
6	5	20%
7	3	15%
10	1	5%

Figure 3

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There were some additional important findings from the Fountas and Pinnell test data. Before using BrainWare SAFARI, 5 of the 20 students were reading below grade level. Afterwards, there were no students reading below grade level. Before using the program, there were 2 students reading above grade level. Afterwards there were 9 students (almost half the class) reading above their grade level, with 4 students were reading at level Z, two more than prior to using BrainWare SAFARI.

## Qualitative Results

Dr. Jardine provided a detailed report of the students' and teachers' experience from a qualitative perspective, incorporated here in her words:

I was told that the classroom teacher would begin to notice changes after a few weeks. This was exactly what happened. The classroom teacher came to me to say that she noticed her students were settling a lot quicker during independent reading, she noted that students would groan when their reading time was over because they were so focused on their reading. She said that her students had developed greater perseverance at tasks; they were more independent workers with more stamina.

When members of our regional school community came down to hear the results of the coaching cycle, they watched the students at work. Next they interviewed the students themselves to ask them firsthand what they thought. The students spoke for themselves, telling how they enjoyed the program, how they were now reading a lot more, how they were changed as learners. They seemed much more secure in who they were as learners and were able to note some differences. There was definitely evidence of the development of higher order thinking skills.

The librarian was invited to come in and speak to visitors. She was very enthusiastic about the progress in the students' reading skills, telling the visitors about how each child had moved on in reading and extending their interests to new materials and series. One student moved from picture books to reading novels. Overall the librarian described a class who visited the library frequently to get reading materials that were out of their previous comfort zone.

The librarian and the teachers had high expectations for these students but they seemed to make greater changes in their reading interests and focus than was normally expected. Everyone was positive, proud and very excited. There was an air that something extraordinary had taken place. Indeed it had!

The students in this trial, worked very hard on Brainware. They were supported in the classroom and the library by being provided and challenged to read rich learning resources. Reflecting on my career in education, I would certainly have to say that I feel the enormous, social, emotional, and cognitive growth in these students was definitely related to BrainWare software. One day, interrupting this grade 4&5 class during their independent reading, I asked them where they had travelled to in their reading that day. The responses varied from a senior's home, to a dark forest, to Milwaukee, to England, Germany, Africa and the Future. The journey these students were on had taken on an incredible voyage that would hold lots of complexity for

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them. I knew they were now better equipped to meet the pitfalls when they appeared on the road.

## Conclusions

The staff at Wycocomagh Education Centre conducted a highly successful cognitive training program for the 4<sup>th</sup>- and 5<sup>th</sup>-grade students in this class. The average improvement in reading skills for the 4<sup>th</sup>- and 5<sup>th</sup>-grade students who used BrainWare SAFARI far exceeded the expected gains in reading over the 12-week period. All of the students ended the year reading at or above grade level, with 20% of the students reading at highest reading level in the system.

Dr. Jardine provided the following conclusions regarding the experience:

The impetus for our BrainWare implementation was the claims I had read of 2-4 years of cognitive growth and 1-2 years of academic growth with a remediation of cognitive skills for students with learning disabilities. What I found out in this trial was that our results surpassed these claims. I had not expected that. I was pleased as were the students and the teacher.

Our quantitative gains were amazing and they were reflected over and over in qualitative gains. These students became wonderful spokespersons for this software. They understood that they had “hit the wall” so to speak, many times with trying to beat the next level in the program but they also knew that they had pushed past their point of frustration time and time again. This gave our students whole new sense of confidence that when the going got tough, they were the ones who got going and pushed past the point of difficulty. I don't think that they will ever be the same when they are presented with a problem that they find difficult to solve.