Maxi Mind Pilot Project

Cheder Chabad, Thornhill, Ontario

Mid-October 2010 – Mid-January 2011

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PURPOSE

The goal of this project was to evaluate the effectiveness of Maxi Mind's brain training protocols to remediate learning difficulties among a very diverse elementary school student population.

PARTICIPANTS

The subjects in this pilot program were not selected randomly. A letter was sent inviting the participation of any interested parents of children who attended Cheder Chabad, an Orthodox Jewish boys' elementary school in Thornhill, Ontario. Interested parents signed their children up for a nominal fee. There were no specific admission criteria.

In total, 20 students joined the program and 19 boys completed it. One boy changed schools. The range of ages was 6-13 years, with a median age of 10. According to the parents and the school administration, each of the boys had at least one significant impediment to successful learning. Some had diagnosed learning disabilities, most did not. Among the known issues were speech and language delay, ADD, ADHD, dyslexia, high functioning autism, anxiety, and oppositional behaviour. Some children were on medication, most were not. Parents completed a registration questionnaire that provided the Maxi Mind team with information about each child's learning strengths and weaknesses.

ASSESSMENT METHODS

All students in the program were made to complete an assessment battery to measure different aspects of their overall functioning before the onset of the program and after its completion. The assessments took about three hours, half of which were pre-tests and half were after the program was done. The following assessment tools were used:

A. IVA+– Officially called "The Integrated Visual and Auditory Continuous Performance Test of Variables of Attention", this is a highly endorsed computerized test of attention and response control. The user is asked to sit in front of a computer screen where he or she is shown a series of 1's and 2's. The numbers either flash on the screen as a visual trial or play over the speaker as an

auditory trial. If the user sees or hears a 1, the mouse must be clicked, but if the user is presented with a 2, it must be ignored. In total 500 trials are presented to the examinee, and the test lasts approximately 15 minutes. The IVA+ produces many scores and sub-scores. For the purposes of this research, the primary 8 scores were recorded and analyzed. They are:

1. **Full Scale Response Control Quotient** – A measure of errors of commission, i.e. how many times the user clicked when he or she was not supposed to click. This assesses impulsivity.
2. **Auditory Response Control Quotient**– A sub-score that measures errors of commission only for the auditory trials. This assesses auditory impulsivity.
3. **Visual Response Control Quotient**– A sub-score that measures errors of omission only for the visual trials. This is a measure of visual vigilance.
4. **Full Scale Attention Quotient-** A score that measures errors of omission, i.e. how many times the user withheld from clicking when in fact he or she was meant to do so.
5. **Auditory Attention Quotient** – A sub-score that measures errors of commission only for the auditory trials.
6. **Visual Attention Quotient -** A sub-score that measures errors of commission only for the visual trials.
7. **Auditory Sustained Attention Quotient** – A measure of consistency, i.e. the ability of the test-taker to sustain a consistent level of response control and attention over the entire course of the test for the auditory trials.
8. **Visual Sustained Attention Quotient** – A measure of consistency, i.e. the ability of the test-taker to sustain a consistent level of response control and attention over the entire course of the test for the visual trials.

B. Wechsler Essentials – Academic Skills – A series of tests used to assess academic knowledge and skills. These tests are widely used in Canadian schools to see how children are doing compared to others of the same grade. There are four components of the assessments: Word Reading, Reading Comprehension, Spelling, and Numerical Operations.

1) **Word Reading** – The test-takers are asked to read aloud a list of increasingly difficult words. The test is finished and a total is recorded when the subject gets four consecutive wrong answers or finishes the entire list.
2) **Reading Comprehension** – The subjects are asked to read passages and answer multiple choice questions of comprehension about them.
3) **Spelling** – Subjects are asked to spell a sequence of words that are read to them orally.

4) **Numerical Operations** – Subjects are asked to solve increasingly difficult math problems until they do not know how to continue.

C. Oral Reading Test – Students were asked to read a passage aloud for 60 seconds. The reading was recorded into an mp3 file which was later marked for the following variables:
   1. **Rate** – The number of words that were read during the test.
   2. **Rhythm** – A scale of 1-3 of how rhythmic the reading was.
   3. **Tone** – A scale of 1-3 on the quality of the tone of voice.
   4. **Self Correction Rate** – The number of stutters, self corrections and false starts made during the reading divided by the total number of words read.
   5. **Error Rate** – The number of actual errors made during the reading divided by the total number of words read.

D. Handwriting Test – Students were asked to copy down a passage onto an unlined blank page for 60 seconds. The handwriting sample was then rated on the following variables:
   1. **Letters Written** – The total number of letters printed during the test.
   2. **Clear Writing** – A scale of 1-3 on how clear the handwriting was.
   3. **Even Letters** – A scale of 1-3 on how even the size of all the letters were.
   4. **Straight Lines** – A scale from 1-3 on how straight the lines were.
   5. **Evenly Placed** – A scale from 1-3 on how evenly the letters and words were placed from each other.
   6. **Copying Error Rate** – The number of writing mistakes made during the handwriting test divided by the total number of letters printed.

TREATMENT PROTOCOLS

Each child received Maxi Mind training 40 times over three months. Each child was taken from class once a day for 50 minutes, four days per week over about 10 weeks. The time slots of these sessions were staggered because it was preferable for the children not to miss the same class more than once in a week. For the most part the students did the sessions in pairs.

The treatment protocol was standardized and had three elements: (1) The Learning Breakthrough Program, (2) the Integrated Listening System, and (3) selected fine motor and cognitive games. Both Learning Breakthrough and Integrated Listening are scientifically developed, proven clinically, used widely in schools, and enjoy a high level of professional endorsement internationally. Normally Maxi Mind works one-on-one and customizes its programs to the needs of each client to increase the program's

effectiveness. In this school trial, the methods were standardized and each coach trained two students simultaneously.

(1) The Learning Breakthrough Program is a 20-minute activity set that varies daily and involves hundreds of specially designed physical exercises grouped into progressively challenging routines performed while standing on an adjustable balance board. The exercises involve free thrown and pendulum balls as well as bean bags and other low-tech tools. The activities act as a whole brain workout because they stimulate, focus and integrate dozens of brain functions including visual, auditory, vestibular, tactile, bilateral, executive and cognitive functions.

The Learning Breakthrough Program has been continuously improved and tested over 35 years under the direction of renowned physiologist, educator and inventor, Dr. Frank Belgau, Director of the University of Houston's Visual Motor Lab. Among the many school trials of Learning Breakthrough was the C.L. Milton elementary school in Laredo, TX where the Principal reported that 83 learning-disabled students between Grades 2 to 5 radically improved their reading and language skills overall. As a group they progressed academically at nearly double the pace of their non-learning-disabled peers, instead of lagging at half the pace as is normally expected.

(2) The Integrated Listening System (iLs) involves a music therapy coupled with its own set of brain-stimulating exercises, generally easier to execute than those of Learning Breakthrough. The iLs listening protocol involves string orchestral music (i.e., classical music) which is filtered at therapeutic frequencies and played through bone conduction headphones that gently stimulate the brain. The acoustic resonance that results adds to the sensory integration experience provided by the exercises.

There are many scientific studies, in educational and psychological literature, attesting to the effect of music on cognitive performance. Integrated Listening is the world leader in this therapeutic method with close to 1000 certified therapists in 20 countries and nearly every state in the USA. Integrated Listening was developed by Dr. Ron Minson, Director of Psychiatry in two Denver hospitals in collaboration with a team of leading occupational therapists. In an iLs study of children in four Denver schools, 19 out of 20 learning-disabled students improved significantly in academic and/or social and/or functional skills and all the teachers and parents were pleased with the results and wanted the program to continue.

In the Pilot Project, iLs was always the first of the three activities. In addition, participants continued the listening component of iLs during Learning Breakthrough and the other brain training activities as well.

(3) Fine Motor and Cognitive Activities and Games. During each therapeutic session there was a 15-minute period where the participant played independently at activities that build fine motor and/or cognitive skills while listening to the music. These activities included play-dough, tracing, colouring, puzzles, mazes, Etch-a-Sketch, Rush Hour, Rubik's Cubes, and I Spy.

After the 40 therapeutic sessions were completed, all students were tested on the same assessment battery they received at the beginning of the program. Care was taken to eliminate "test effect" by using different test content in the post-tests than was used in the pre-tests.

RESULTS

Note: In addition to a narrative description of our results, we also report some statistics. To explain: When we say that improvements are statistically "significant" we mean that there is less than a 5% chance of getting such results randomly. When we say they are "highly significant", the chance that the results are random is less than 1%. Saying the results are "very highly significant" means the chances are less than 1 in a 1000 that the results are random.

Also: "Effect size" is a measure of the magnitude of improvement. Effect sizes were calculated using a widely accepted statistic called Cohen's "d". Cohen's "d" values from 0.2 - 0.5 denote small effect sizes; values between 0.5 - 0.8 are medium sized; and values over 0.8 are considered large.

IVA +

The IVA+ results show that after Maxi Mind training, students were able to focus much better, more consistently and for a longer period of time. This effect was statistically significant for both visual and auditory attention but improvements were more dramatic with visual attention.

The results show that overall, the participants showed statistically significant improvement in Full Scale Attention. The ability to sustain attention over time was also significantly improved, and this was true for both Sustained Auditory Attention and Sustained Visual Attention.

Of these significant variables, Sustained Auditory Attention had a medium effect size and Full Scale Attention, Visual Attention and Sustained Visual Attention each had large effect sizes.

The statistical results of the IVA+ Assessment are shown in Table 1 below:

Variable	Mean 1	Mean 2	Standard Error	M2-M1	t	Df	P	Effect size (d)
Response Control Quotient (Auditory)	88.75	97.30	4.443	8.55	1.924	19	0.069	-
Response Control Quotient (Visual)	99.70	96.00	6.772	-3.70	-0.550	19	0.588	-
Response Control Quotient	93.55	99.05	4.118	5.50	1.335	19	0.197	-
Attention Quotient (Auditory)	98.60	102.45	3.330	3.85	1.156	19	0.262	-
Attention Quotient (Visual)	97.45	107.25	2.700	9.80	3.630	19	0.002**	1.15
Attention Quotient	97.60	105.55	3.083	7.95	2.578	19	0.018*	0.82
Sustained Attention Quotient (Auditory)	95.25	103.90	3.713	8.65	2.330	19	0.031*	0.74
Sustained Attention Quotient (Visual)	94.95	104.75	3.830	9.80	2.559	19	0.019*	0.81

Table 1 – Statistical Table Analyzing Improvements in Attention Following Maxi Mind Training
*** = significant, ** = highly significant**

Wechsler Academic Skills

Following Maxi Mind training, performance on standardized tests of math and reading comprehension improved significantly, and the average increase in reading comprehension was quite dramatic.

Variable	Mean 1	Mean 2	M2-M1	Standard Error	t	df	p	Effect size (d)
Word Card Reading	82.63	77.37	-5.26	2.54	-2.069	18	0.053	-
Reading Comprehension	71.06	86.67	15.61	5.15	3.032	17	0.008**	0.94
Spelling	68.68	71.47	2.79	1.98	1.411	18	0.175	-
Numerical Operations	84.74	89.00	4.26	1.86	2.29	18	0.034*	0.57

Table 2 –Analysis of Wechsler Tests of Academic Skills Scores Before and After Maxi Mind Training
*** = significant, ** = highly significant**

Reading and Writing

Following Maxi Mind training, students were able to read and write much more quickly and accurately.

The results show very highly significant improvements for Reading Rate. Following training, the average child read about 18 words more per minute than before. Additionally, children read with significantly fewer Errors per Word. There were 35% fewer errors per word and the effect size was also large.

For writing, the number of Letters Printed per Minute increased to a highly significant degree. After Maxi Mind, the average participant wrote 25% more letters per minute and the effect size was large. The Results of the reading and writing tests are shown in Table 3 below:

Variable	Mean 1	Mean 2	M2-M1	Standard Error	T	df	p	Effect size (d)
Reading Rate	82.84	100.58	17.737	3.422	5.183	18	0.000***	1.8
Reading Self Corrections Per Word	0.067	0.054	-0.013	0.007	-2.013	18	0.059	-
Reading Errors Per Word	0.057	0.036	-0.021	0.009	-2.267	18	0.036*	-1.1
Writing Letters Printed per Minute	37.29	47.71	10.42	2.905	3.584	16	0.002**	1.23
Writing Errors Per Letter Printed	0.025	0.011	-0.014	0.010	-1.341	16	0.199	-

Table 3 – Statistical Table Analyzing Improvements in Reading and Writing Following Maxi Mind Training
*** = significant, ** = highly significant, *** = very highly significant**

DISCUSSION

The fact that learning abilities improved so much due to Maxi Mind is particularly noteworthy in light of four factors that constrained its success: (1) Each student missed 40 hours of class time and hence would be expected to have suffered academically. Instead they improved; (2) The therapeutic time was not spent on any academic pursuits – just brain stimulating music, exercises and games. Nonetheless their academic skills improved; (3) In the pilot program, Coaches worked one-on-two with participants instead of one-on-one which yields better results; Even so, there were many major improvements; (4) The treatment protocol in the pilot program was completely standardized, unlike the more effective method of a customized program.

Parental recognition and approval is another, although less formal, measure of success. After completing an essentially free pilot program, one third of the participants re-registered for another course

but this time at unsubsidized prices. At the same time seven more Cheder children, none of whom had taken the pilot program, signed up for Maxi Mind courses. A few other observations demonstrate other successes in a qualitative, rather than quantitative, way:

- One boy went from the bottom of the class to the top and has finally started to enjoy school;
- One parent with 3 children in the program saw behavioural and social improvement in each;
- A boy who was constantly stymied by homework now cheerfully does it easily every night;
- A boy who frequently had uncontrollable fits of rage now self-regulates when frustrated;
- A boy is suddenly able to listen to the teacher while copying notes from the board;
- A boy who was constantly tuned out can now participate in class and keep pace with work;
- One boy not only improved in class. He is also less tense and speaks more clearly, too.
- Another boy is more coordinated and for the first time was not excluded from class sports.
- Another student can now look people in the eye and connect better socially at home and at school.
- Instead of the stigma normally associated with Special Ed, Maxi Mind students are seen by their friends as privileged.
- A child who previously hated school, now enjoys it.

CONCLUSION

The pilot program at Cheder Chabad has demonstrated that Maxi Mind treatment protocols help to generally improve academic skills and the ability to concentrate in school children of varying age and with diverse learning difficulties.

Statistical analysis of standardized tests showed that (a) Reading and writing speed and accuracy were greatly increased; (b) Math skills and especially reading comprehension skills improved considerably; (c) Students were able to focus for longer periods of time and with greater ease and consistency. In addition, problem behaviours that interfere with learning were diminished, mood tended to stabilize and elevate, and social skills were enhanced. Maxi Mind is an important remediation option for educators.