

THE IMPLEMENTATION OF A MEDIATED LEARNING PROGRAM WITH  
LEARNING-DISABLED STUDENTS AT BEN BRONZ ACADEMY

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7/8 Name: -

\_\_\_\_\_

Date \_\_\_\_\_

**A Checklist for Independence \***

Rate yourself on each of the following items between 10 and 1.

**10** means you are perfect in this skill

**5** means that you use this skill half of the time

**3** means that you know the skill, but do not use it

**1** means that you do not have this skill

### INPUT SKILLS

\_\_\_\_\_ I PREVIEW texts or notes before class.

\_\_\_\_\_ I WARM UP before class. I use \_\_\_\_\_ and \_\_\_\_\_

\_\_\_\_\_ I keep an AUDIT TRAIL by putting my name, the date, and the name of the class on each page.

\_\_\_\_\_ I INQUIRE, rather than sit back in the class.

\_\_\_\_\_ I ask for diagrams and outlines, or I make them myself.

(3 SENSE LEARNING.)

\_\_\_\_\_ I use tapes, visuals, models, or computer programs to review.

(3 SENSE LEARNING.)

\_\_\_\_\_ I find the important facts when reading or taking notes from lectures.  
(ANALYZING)

\_\_\_\_\_ I GATE. When I do not understand a word or sentence, or when I cannot keep up to what is being said, I raise my hand and ask the lecturer to repeat or explain.

\_\_\_\_\_ I choose 10 or fewer important facts. (PARSIMONY)

\_\_\_\_\_ I write new words on a VOCABULARY List.

\_\_\_\_\_ I study my VOCABULARY List daily, and in my spare time.

\_\_\_\_\_ I use a Plan Book. (TEMPORAL EFFICIENCY.)

\_\_\_\_\_ I write all of my homework in the Plan Book without being reminded.

(TEMPORAL EFFICIENCY.)

\_\_\_\_\_ I plan long-term assignments in orderly, efficient steps.

(TEMPORAL EFFICIENCY.)

\_\_\_\_\_ TOTAL (out of 140 possible points.)

**Independence Checklist. (Page 2)**

Rate yourself on each of the following items between 10 and 1.

**10** means you are perfect in this skill

**5** means that you use this skill half of the time

**3** means that you know the skill, but do not use it

**1** means that you do not have this skill

**ELABORATION SKILLS**

\_\_\_\_\_ I clearly define each new problem. (PROBLEM SOLVING)

\_\_\_\_\_ I use a 7 Step Plan to solve difficult problems. (PROBLEM SOLVING)

\_\_\_\_\_ When Problem solving, I am not distracted by irrelevant information.

\_\_\_\_\_ When Problem solving, I work with the whole idea or task in my mind. I do not break it into little parts, then lose track. of what I am doing.

\_\_\_\_\_ I only start to solve the problem after I obtain all materials and information needed. (PROBLEM SOLVING.)

\_\_\_\_\_ I try alternate ways to solve tough problems, then ask for help if I still need it. (PROBLEM SOLVING.)

\_\_\_\_\_ I SYNTHESIZE facts into an organizing principle or Main Idea

\_\_\_\_\_ I CONTEXTUALIZE new words.

\_\_\_\_\_ I BRIDGE each new concept I learn, applying it in other areas of my life.

\_\_\_\_\_ I CLUSTER new words and concepts to help me understand them.

\_\_\_\_\_ I IMAGE new material.

\_\_\_\_\_ I MATRIX, connecting new words or facts to my previous learning in several ways.

\_\_\_\_\_ I INFERENCE the meaning of new words, then look them up. I INFERENCE the main idea of paragraphs in which it is not directly stated.

\_\_\_\_\_ I RESOURCE by looking up information I do not know.

\_\_\_\_\_ I SUMMATE at the end of each page of notes, or the end of a chapter or book.

\_\_\_\_\_ I TRANSFER skills I learn in one area to other areas.

\_\_\_\_\_ When I have my work corrected, I ANALYZE my ERRORS and learn what I must do to improve my product.

\_\_\_\_\_ I set appropriate GOALS for myself in learning situations.

\_\_\_\_\_ I complete two FLUENCIES daily in activities that require automaticity.

\_\_\_\_\_ I complete all of my HOMEWORK.

- \_\_\_\_\_ I complete my HOMEWORK on time.
- \_\_\_\_\_ I check my own work for correctness. (FEEDBACK)
- \_\_\_\_\_ I use my mediator's or peers' comments as a guide toward improving. (FEEDBACK).
- \_\_\_\_\_ TOTAL (*out of 240 possible points.*)

**Independence Checklist, Page 3**

Rate yourself on each of the following items between 10 and 1.

**10** means you are perfect in this skill

**5** means that you use this skill half of the time

**3** means that you know the skill, but do not use it

**1** means that you do not have this skill

**OUTPUT SKILLS**

Speaking Skills:

- \_\_\_\_\_ I attempt to speak PRECISELY.
- \_\_\_\_\_ I try to be ELOQUENT when speaking, by using parsimony, and choosing the correct words.
- \_\_\_\_\_ I attempt to say my statements in an interesting way. (ELOCUTION)

Writing Skills:

- \_\_\_\_\_ I write an OUTLINE before I write a paper.
- \_\_\_\_\_ I make my sentences PRECISE.
- \_\_\_\_\_ I TAKE NOTES by writing key facts, then adding to my notes after classes
- \_\_\_\_\_ I SOLJDIFY my thinking by writing or saying a thought to make it clearer.
- \_\_\_\_\_ I EDIT my work carefully.
- \_\_\_\_\_ When corrected work is returned to me, I REPAIR any error I made.

Work Load:

- \_\_\_\_\_ When work piles up, I problem-solve and plan a schedule to get it done.
- \_\_\_\_\_ I keep cool under pressure.
- \_\_\_\_\_ TOTAL (*out of 110 possible points.*)

OUTPUT QUANTITY

For the following questions, fill in the number of pages you can complete. (Maximum is 55.)

I can read and outline \_\_\_\_\_ pages of texts or reference works per day.

I can complete \_\_\_\_\_ pages of essays or reports per month.

\_\_\_\_\_ TOTAL (*out of 11 possible points*)

My Independence Score:

\_\_\_\_\_ First Page (Input) Total (*140 possible points.*)

\_\_\_\_\_ Second Page (Elaboration) Total (*240 possible points.*)

\_\_\_\_\_ Third Page (Output) Total (*110 possible points.*)

\_\_\_\_\_ (Output Quantity) Total (*110 possible points.*)

\_\_\_\_\_ Independence Score (the total of all of the pages) (*600 possible points.*)

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Abstract

The implementation of the Feuerstein Mediated Learning approach using materials from the Instrumental Enrichment program over a sixteen-year period with learning-disabled students at the Ben Bronz Academy in Connecticut was analyzed. Significant positive measured effects were noted in general reasoning skills, self-ratings of Independence as a learner, Analysis-Synthesis, Oral Language, Concept Formation, and Short-Term Memory. Separate teacher ratings of students indicated that students generalized cognitive strategies across subject matter, acquired problem-solving strategies, and increased their self-confidence. A number of factors would explain the results, including daily instruction in Instrumental Enrichment, application of a Feedback Awareness System, a longer school day, content-based courses, fully certified teachers, and smaller staff-student ratio. Statistical results are available.

INTRODUCTION

Reuven Feuerstein (1980) has addressed higher-order thinking skills in a framework called Mediated Learning Experiences in a program that he calls Instrumental Enrichment (IE). This method and curriculum has been used by the Ben Bronz Academy

as part of a comprehensive approach over a period of sixteen years with severely learning-disabled students.

Mediated learning provides learners with a broad array of problem-solving strategies in an engaging format, using unique paper-and-pencil exercises and the expert coaching of specially-trained teachers.

Some of the cognitive functions enhanced by the program include:

Comparison	Time Relationships
Categorization	Numerical Relationships
Finding Patterns	Creating and Following
Orientation in space	Exact Instructions
Overcoming impulsivity	Using Logic
Analysis	Being Precise

All activities are designed to increase the individual's capacity for learning.

Each set of cognitive functions is taught through a thematic collection of activities, known as an "Instrument", using content-free materials that the learner then uses to make applications (or "bridges") to applications to school subjects and to the outside world. In all, IE has a total of 14 different instruments for older learners, while the early-childhood version has 10 instruments, each on a different cognitive theme.

An important part of the learning process is "metacognition", in which the learner is led to consciously reflect on the mental processes she or he is using in order to solve the problems; thus, the learner eventually becomes independent because she or he develops a clear sense of the mental tools that she or he should use in most problem-solving situations.

The role of the teacher is unique in that she or he acts, not as a teller of information, but instead as a "mediator"---one who suggests strategies, asks leading questions, and coaches, so that the learner is

actively involved in the problem-solving process.

## BACKGROUND OF THE STUDY

The Ben Bronz Academy in West Hartford, Connecticut, has incorporated a multi-year commitment to the infusion of MLE across their entire instructional program, designed specifically for learners with learning disabilities. The program of the school is a private tuition-based academic day school, serving up to 60 students each year in grades 2-12. The faculty-student ratio is approximately one to three, with class sizes ranging from one-on-one instruction to groups of up to ten students; average class size is four. The school is an Approved Private Special Education Facility, approved by the Connecticut State Department of Education; approximately 75% of students at the school are funded completely by their public school systems. A majority of students return after their time at the school, which has averaged 2.4 years to date.

The present study analyzes the results of MLE with students from ages 11-13 over a sixteen-year time period. Metacognition forms the basis of the school's teaching methodology, helping students become aware of their own thought processes and of the language that they use in developing problem-solving strategies. Language-skill development is stressed at all grade levels and in all classes. Strategies for developing independence permeate all classes, with the main strategies of Active Learning and data-based measurement of progress being used by both teachers and students. The reading system incorporates specific activities to develop phonological awareness, word analysis, decoding, fluency, text analysis, and comprehension. Student performance

data are analyzed regularly, and modifications to the curriculum and instructional methods are made accordingly.

All students at the school have been independently diagnosed with learning disabilities prior to admission; 80% of the students have language-based learning disabilities accompanied by severe deficits in reading and written language. Approximately 20% have non-verbal learning disabilities, frequently accompanied by weaknesses in mathematics and written language. Nearly half of the students have concomitant attention deficit/hyperactivity disorder, anxiety, obsessive-compulsive disorder, or similar behavioral challenges. No students have primary emotional disorders. A special system, the Feedback Awareness System (FAS), is used at the school as a method of increasing students' continuous awareness of their own behavior and how it impacts learning; it is a tally system used by all teachers in all classes to identify student behaviors that either help or impede student learning (Stan-Spence, 1994; Sharp, 2008). The student "earns" a tally on the whiteboard when the mediator sees the behavior occurring. The tallies are totaled and entered into a data base at the end of each class session. The ratio of positive to negative behaviors is approximately 10 to 1; no tangible rewards are used. As a result of this system, students become aware of what they do that either inhibits or enhances their learning.

The average length of stay of a student at the school is 2.4 years; hence, the design of the present study was based on following several cohorts over two-year intervention periods.

## LITERATURE BACKGROUND

Over the past decade great emphasis has been placed on incorporating programs and instructional strategies to enhance the ability of children to think critically. Not until recently have these programs been used in the special education classroom. In the past, special education consisted of learning activities concentrating on teaching the “basics”, assuming that students with learning disabilities cannot benefit from instruction in higher-order thinking and reasoning until basic skills are mastered. For example, Cook, Klein, and Tessier (2008) recommend that for students with learning disabilities, content be presented in “short segments”, tasks be broken down into small steps, and concrete examples be used for new concepts. In addition, Smith et al. (2006) describe “traditional” methods of working with these students to include use of worksheets and workbooks, frequent drill, and repetition. Smith et al. recommend that teaching begin with “simple” activities focused on a single concept (2006). Woodward and Noell (1992) had maintained that while the inductive style of teaching using inquiry and critical thinking “may be successful at teaching *some* students higher order thinking in the context of specific subject material, there is little evidence that it is effective for students with learning disabilities” (p. 42).

On the other hand, in recent years some authorities in the field have found fault with these approaches. Gersten and Chard (1999) indicate that drilling on number facts in mathematics has led to a lack of general understanding. Cawley and Foley (2001) propose teaching big ideas in math and using techniques that promote students as problem-solvers rather than as routinized learners. Bryant, Smith, and Bryant (2008) indicate that many of these students benefit from being taught strategies to help them to organize, identify, understand, and remember information. Thus, the field is gradually

opening to new approaches, and the techniques being described below as used at the Ben Bronz Academy with mediated learning do exemplify those trends.

## THE GENERAL CURRICULUM

Higher-order thinking strategies are flexible, improving skills throughout all subjects in the curriculum. Several researchers have suggested the need to address higher-order thinking skills for learning-disabled students in the areas of: reading comprehension (e.g., Williams, 2005; Gajria, Jitendra, Sood & Sacks, 2007; Bos, Anders, Filip & Jaffe, 1989; Darch & Gersten, 1986; and DiCecco & Gleason, 2007); history (e.g., Bulgren et al., 2007); science (e.g., Leshowitz, Jenkins & Heaton, 1993; Scruggs, 1993; and Mastropieri, 1997); and mathematics (e.g., Desoete, 2001).

## PROBLEM-SOLVING

As inclusion of special-needs students in regular classrooms and accountability continue to be two foci of American education, teaching critical thinking to all students with disabilities is crucial to their success in the general education setting. Expectations for all students, especially students with disabilities, are continually increasing, and their problem-solving skills should increase as well. Agran, Blanchard, Wehmeyer, and Hughes (2002) note that problem-solving remains a neglected subject area; yet, it is of great importance because being able to solve problems increases self-determination and success in the community. After teaching four students with developmental disabilities several problem-solving skills to achieve self-established behavior goals, the authors investigated the effectiveness of instruction using ending behavior as resulting evidence.

Students in the study were taught one specific problem-solving strategy, but were actually using several because the authors state that “problem solving involves several overlapping strategies, including goal-setting, self-monitoring, and self-evaluation” (Agran, et al., 2002, p. 286). The findings from this study provide clear evidence that students with developmental disabilities have the ability to learn and use problem-solving techniques to achieve self-set goals and use them successfully in an inclusive setting.

#### FEUERSTEIN’S INSTRUMENTAL ENRICHMENT (IE)

More than twenty years of research has been done on one particular program developed in the 1980’s, Feuerstein’s Instrumental Enrichment. Reuven Feuerstein developed this program to teach “slow-learning, culturally-deprived” adolescents to properly use thinking strategies. Today, although the terminology has been changed to “students with disabilities”, the struggles by these students have not changed. How effective is this specific program in today’s classrooms and for today’s students with learning disabilities? A review of past and present literature consisting of quantitative data, qualitative data, arguments, and limitations which all display the differing professional opinions and results will help to answer this important question.

Founded on two major concepts, structural cognitive modifiability and mediated learning experiences, Feuerstein’s Instrumental Enrichment program was developed to improve the critical thinking skills of young adolescents. Some of the characteristics of students with learning disabilities include but are not limited to the following: (1) lack of precision, (2) poor organization skills, (3) difficulty forming hypotheses, (4) minimal attention and memory, and (5) language and discrimination difficulties (Messerer, 1984).

Through various research studies, the quantitative, measurable data are found primarily relating to students' improvement in general cognitive strategies (Martin, 1984; Messerer, et al., 1984; Feuerstein, et al., 2004; Head & O'Neill, 1999), academic achievement (Narroll, Silverman, & Waksman, 1982; Unruh & Dupree, 1998; Feuerstein, et al., 2004), and transferability of acquired skills (Galyam & Le Grange, 2005; Shayer, 1987). Investigations into the effects of Instrumental Enrichment have been carried out over the past 25 years in several countries, including the USA, United Kingdom, Australia, South Africa, New Zealand, Israel, Spain, Venezuela, France, and Germany; nearly 300 studies have been completed and more are constantly in process. These studies have encompassed many kinds of populations of students, including students with Down's Syndrome, autism, ADHD, traumatic brain injury, and learning disabilities.

A recent example is a study completed in 2002 in Cleveland, Ohio high schools, in which it was found that 9<sup>th</sup> grade students who had an approach that incorporated IE within their mathematics program doubled their rate of improvement on the math test scores when compared to a control group (VLS, 2002).

It has been found that in working with special-needs learners, it is not necessary in every case to make major adjustments in IE instruction, since the materials provide a balance among the visual, geometric, verbal, and symbolic representations. Adjustments made by teachers for special populations include a somewhat slower pace, visual expansion of the pages into larger type size for visually impaired students and for those needing a slower pace, teaching the meaning of key terms to which special-needs learners may not have

been exposed previously, and teaching the pre-requisite skills in a concrete modality before attempting the paper-and-pencil IE pages.

Discussion lies at the “heart” of the methodology of “mediation”, which has a profound positive impact on learning-disabled youth, in particular the focus on identifying patterns (Messerer et al., 1984). Brainin (1982) conducted a study of how an emphasis on mediation transcends many individual differences that are caused by some disabilities. Specifically in regard to learning disabilities, IE approaches were found to have a positive effect in a rural Westchester County, New York school with underachieving 6<sup>th</sup> grade students, reading two years below grade level in remedial classes. The experimental group had 59 hours of IE instruction over one school year, while the control group had equivalent hours in a remedial reading program. As measured by the Comprehensive Test of Basic Skills (CTBS), significant positive differences in favor of the IE group were found on Total Reading gain scores. Sanches (1994) conducted a three-year study with 8-year-old rural public school students who had poor language skills as measured by the Test of Language developed by Pozar in 1983; the study compared 25 IE students with 25 students in a control group. The comparison of pre-test and post-test scores indicated significant differences in favor of the IE group on all four subtests of language (oral, written, vocabulary, and grammar).

After completing the Instrumental Enrichment program, the students’ use of cognitive strategies has shown significant improvement. Messerer et al. (1984) conducted a pilot study testing the effects of one part of Instrumental Enrichment which emphasizes pattern recognition on the organizational skills of four post-secondary students. The task “requires the learner to identify geometric figures embedded within an

amorphous cloud of dots” (Messerer, et al., 1984, p. 323). The results of this study indicate “potential power” and “optimistic promise” (Messerer, et al., 1984, p. 324) for students with learning disabilities to improve in their organizational skills and problem-solving techniques. Fifteen years later, Head and O’Neill (1999) conducted a similar study investigating only that same task and a task involving personal orientation using six students. Using a pre and post survey as the source of evidence, the authors concluded that five out of six students significantly decreased their cognitive deficiency (Head & O’Neill, 1999).

At about the same time as Messerer et al. investigated pattern recognition, Martin (1984) conducted another pilot study using hearing impaired students, but tested the whole program. Using experimental and control groups, the effectiveness of the entire program was tested on improving cognitive functions, problem-solving, and reading comprehension. The results of this study were also positive, displaying student improvement in: “(a) systematic approaches to problems, (b) analysis of problem strategies, (c) vocabulary size, (d) analysis of source-of-error in problem-solving strategies, (e) completeness, organization, and planning in problem-solving situations, (f) peer cooperation in problem-solving, (g) abstract thinking, (h) precision, and (i) development of multiple strategies to solve a problem” (Martin, 1984, p. 235).

Research done by Feuerstein et al. in 2004 compared the Instrumental Enrichment program to a General Enrichment program using 58 pairs of adolescents with learning disabilities. The primary question for this study was, “Does participation in the Instrumental Enrichment program result in better performance on general and specific cognitive tests, scholastic achievement, classroom interactions, and self-concept than

does participation in a General Enrichment program” (Feuerstein, et al., 2004, p. 22)?

The results were varying in degree. Substantial support was found for Instrumental Enrichment’s improvement of cognitive strategies versus the General Enrichment, partial support for impact on academic achievement and classroom behavior, and no support for improved self-concept.

Narroll, Silverman, and Waksman (1982) designed a study to see the effects of the Instrumental Enrichment program on cognitive ability and whether there was subsequent improvement on school achievement. After taking five experimental and four control classes through the program, the results indicated that the students did improve on general cognitive ability, but those skills did not help them improve their academic performance. In 1992 a study done by Unruh and Dupree used eleven preschool children in special education; the authors tested whether their scores on standardized academic testing would improve after completing the Instrumental Enrichment program. Their “results indicated that students’ scores on the Brigance Diagnostic Inventory of Early Development showed significant gains on pretest and posttest performance” (Unruh & Dupree, 1992, p. 134).

In a review of 38 studies of Instrumental Enrichment, Sternberg and Bhana (1986) observed that at least three factors must be present and working properly for Instrumental Enrichment to be successful: (1) sufficient classroom time for the long duration of the program, (2) teacher knowledge, skill, and training, and (3) separate instruction time.

## SAMPLE POPULATION

A sample of students from the Academy were identified for the present study, encompassing their academic progress for the years 1986 to 2006 as a cohort. The sample included 135 students in grades 6 and 7 and contained 101 boys and 34 girls. Ten student cohorts were measured over a two-year period in each case, beginning with their entry to the Academy in grade 6 or grade 7 and their end-of-year testing at the end of two years (some of the students stayed on at the school after this time). Student background was varied and included students whose families were relatively well-to-do and some other students whose income was very limited. All students were in attendance on a full-time basis during the data-collection period. No comparison group was available because all students at the Academy were given the same instruction. Data were examined and no significant differences were found between groups based on gender, grade level, or year in cohort.

Intervention with the Mediated Learning approach took place throughout the research period on a daily basis of 43 minutes of instruction with the Instrumental Enrichment materials; in addition, all teachers, including those in classes where the program was not explicitly used, employed a mediated learning approach to their teaching.

#### TYPES OF DATA AND DATA ANALYSIS

Five sources of data were accessible for the research study:

1. Scores of students on the Raven's Standard Progressive Matrices Test (1949) on a pre and post basis; this test is considered to assess general reasoning skills.

2. Student scores on the Woodcock-Johnson Tests of Cognitive Abilities, Analysis/Synthesis, Concept Formation, Short-Term Memory, and Oral Language (Woodcock-Johnson, 1978, 1989, 2001)..
3. Student results on the school's Checklist of Independence, which is a self-assessment instrument.
4. Advisor Assessments of individual students' skills on the above Checklist of Independence.
5. A content analysis for repeated themes in a special Teacher Focus Group that took place in spring of 2007.

For the Ravens test, the four tests of the Woodcock-Johnson, and the Checklist of Independence, three mean scores were obtained: at entry into the school, at the end of Year 1 of intervention, and at the end of Year 2 intervention.

Raven's Matrices scores were scored on the basis of percentiles relative to items correct and summed across the pre-test students in the sample; the mean score for the pre-test was compared to the mean of the post-test for students in the sample. All students were included in both the pre and post tests.

Standard scores on the Woodcock-Johnson Tests were obtained, and means compared for all four tests. Scores on the Checklist for Independence were tallied and means were obtained for both students and their advisors. The Student Self-Assessment was conducted with all students who were in grades 6-12 only in the Spring of 2007; scores were obtained by summing the values for each position on the rating scale, subdivided according to the categories of Input skills, Elaboration(processing) skills, and Output

skills; an overall score for Independence was also calculated. The Advisor Assessments were conducted in the Spring of 2007.

The Teacher Focus Group took place in the spring of 2007 and asked teachers to reflect on how the teaching with Instrumental Enrichment had changed both their own teaching and how students functioned cognitively.

## LIMITATIONS

Several limitations must be noted in relation to the design of the present study.

1. No comparison group was possible because all research subjects had the experimental treatment; thus, the comparisons with research subjects not having the treatment were made to the norms of the various standardized measures being used. Hence, the present study is descriptive.
2. While all research subjects were diagnosed as learning-disabled, some variation in their types of disabilities is noted, as is explained in the section on Setting of the Study.
3. Not all of the measures were used uniformly throughout the research time period, although sufficient repetition of measures was possible in order to derive data-based findings.
4. One of the measures—the checklist of Independence—is not a standardized instrument.
5. From year to year, some variation occurred in the specific implementations of the intervention, but the common element across the entire intervention for the entire period of time of the study is mediated learning experiences.

## FINDINGS

On all of the cognitive measures, no significant differences were found with regard to students' gender, grade level, or the particular version of the three versions of the Woodcock-Johnson Test of Cognitive Abilities that they took. Numerous significant gains were noted between entry into the school and at the end of the first year of intervention with IE.

The following specific findings are reported:

1. Correlations were first computed on the scores of the Ravens and the four subtests of the Woodcock-Johnson Tests of Cognitive Abilities to ascertain the level of intercorrelations. Correlations were high (between .46 and .69, with two exceptions), which caused the researchers to subsequently set the level of acceptable statistical significance on tests of difference between means, at a high level. However, these high intercorrelations also indicate that the cognitive strategies as measured by these various instruments do relate to each other closely.
2. Scores on the Ravens test showed a statistically significant improvement from the time of entry to the end of Year 1 of the intervention, using a Wilcoxon Signed Ranks Test (mean of 44.9 to a mean of 60.7); interestingly, however, no statistically significant difference was found between the end of Year 1 and the end of Year 2 (in fact, a slight non-significant decline occurred to a mean score of 58.0). A paired samples T test indicated statistically significant gains between entry and the end of the first year of intervention ( $p < .0001$ ).

3. Scores on the several tests of the Woodcock-Johnson were submitted to Paired Samples T-Tests. The Analysis-Synthesis test showed a similar pattern of improvement to those noted on the Ravens test (entry-level mean of 102.2 vs. end of Year 1 mean of 107.4), which was again statistically significant; however, similar to the scores on the Ravens test, a slight non-significant decline was found by the end of Year 2 (mean of 105.4) ( $p < .001$ ).
4. Scores on the Concept Formation test of the Woodcock-Johnson Tests of Cognitive Abilities also showed a positive pattern. A statistically significant improvement was found between entry and the end of Year 1 (means of 100.4 vs. 107.2), but continued improvement was also noted by the end of Year 2 (mean of 110.6), although the difference between means for Year 1 vs. Year 2 was not statistically significant ( $p, .001$ ).
5. Mean scores on the Short-Term Memory test of the Woodcock-Johnson again showed a statistically significant improvement from entry to the end of Year 1 (means of 87.2 to 91.8), and a small but non-significant improvement to a mean of 92.1 by the end of Year 2. A Paired-Sample T-test indicated a small but significant gain between Year 1 and Year 2 ( $p < .001$ ).
6. Mean scores on the test of Oral Language of the Woodcock-Johnson showed a statistically significant improvement between entry and the end of Year 1 (means of 96.8 vs. 100.5), but a slight non-significant decline to a mean of 99.8 by the end of Year 2 of the intervention. A Paired-Sample T-test indicated a small but significant gain between Year 1 and Year 2 ( $p < .001$ ).

7. A composite of the Analysis-Synthesis and Concept-Formation tests of the Woodcock-Johnson was also computed, to obtain a score for “fluid reasoning”. That calculation, not surprisingly, was similar: a statistically significant difference at the .0001 level was found between the mean scores for entry (99.6) and at the end of Year 1 (106.4), and a virtually unchanged mean score (106.6) by the end of Year 2.
8. The Checklist for Independence (see Appendix A) asked 48 students and their advisors to indicate on a scale of 0 (“I don’t know what this item is”) to a high of 10 (“I am completely independent in using this skill appropriately”), and points on a continuum in between, how they saw themselves (and how advisors saw them) in regard to items related to different specific cognitive skills for problem-solving at the end of the 2006-2007 school year. Student mean self-rating for the 14 items related to input was 83 out of a possible total of 140; 117 for elaboration out of a possible total of 230; and 62 for output out of a possible total of 110.
9. The evaluation by advisors on their students’ Independence Checklist of skills followed a similar pattern: 81 for input skills, 116 for elaboration skills, and 56 for output skills. T-tests were performed on the comparison of students’ and advisors’ ratings, and no significant differences were found on input or elaboration. However, students rated their output skills significantly higher than their advisors did ( $t=3.257, p<.002$ ).
10. Further analyses were carried out in order to compare the self-perceived cognitive skills of those students who had had one year of instruction using IE, those who had two years of instruction using IE, and those who had three or more years of

instruction using IE. Students with three or more years of IE rated their input significantly higher than those with two years of IE ( $p < .03$ ). (Interestingly, the advisors rated the input skills of students with one and three years of IE experience higher than those with two years of experience, possibly due to some uniqueness in the composition of the second-year group.)

11. An analysis of the content patterns from the Teacher Focus Group indicated some useful qualitative data. Eighteen teachers participated in the Group, each having an opportunity to contribute ideas; several teachers also responded to others' previous comments in a typical Focus Group format. Teachers indicated three principal ways in which the program assists students:

- a. The highest frequency of comment (one third of the group) was about how Instrumental Enrichment enables students to acquire cognitive strategies which generalize across subject matter in the curriculum.
- b. A number of teachers also pointed out that the program enables students to develop a plan for problem-solving.
- c. Several teachers remarked about how the program helps students to "feel confident" and "not be afraid" to try different approaches to solving problems.

Several teachers also indicated two ways in which teaching in the program improved their own teaching style:

- a. Using the program enhanced teachers' abilities to use "wait-time" after posing questions to students.
- b. Using the program enhanced teachers' ways of encouraging students

to “feel competent”.

Other single comments by teachers noted the effects of the program on students’ abilities to: think sequentially, become aware of cognitive strategies, acquire structure in their thinking, taking time to think a problem through, mediate for their peers, develop a “map” for their learning, break egocentrism, be more precise, and select the right “language” to use in solving a problem.

Individual teachers also commented on further impacts of the program on their ability to teach using: awareness of student strengths, differentiation of instruction, a focus on process rather than product, and active listening to the teacher.

12. At the school, some students who are not yet ready for entirely paper-and-pencil thinking exercises are instead at first provided with an adapted approach using the same techniques of mediation incorporated within the Instrumental Enrichment method; the school labels this approach as the Meta Learning Program (MLP) (Stan-Spence, 1993). In the cohort reported in this analysis, 36 sixth grade students had MLP during their first year at the school prior to moving to entirely paper-and-pencil mediation. In order to identify in finer detail the effects of this adaptation compared to the effects of the actual Instrumental Enrichment (IE) program, means and standard deviations for both MLP and IE subgroups were calculated, and then ANOVA was performed on the comparisons; no significant differences between the MLP and the IE groups were noted on any of the measures (Raven’s Standard Progressive Matrices, Analysis-Synthesis, Concept Formation, Short-Term Memory, and Oral Language) at the time of entry. Separate statistical analyses

compared progress of the two groups (MLP and IE) from time of entry to post-mediation at the end of their first year of intervention. ANOVA was also performed on the differences and no significant differences were found on Analysis-Synthesis and Concept Formation (the two reasoning tests); however, significant differences in favor of the IE group were found on the tests of Short-Term Memory and Oral Language. One possible explanation for this difference is that the MLP group is constituted of students who are found to be more language-impaired and were slightly younger than the IE group (mean age of 11 years 7 months as opposed to 12 years 4 months). A further analysis was performed on the comparison of second-year scores for the two groups; no significant differences were found between the two groups on Analysis-Synthesis, Concept Formation, and Oral Language, but the Short-Term Memory gains still favored the IE group. (Tables showing means and standard deviations for both groups at time of entry, end-of-first-year, and end-of-second year are available upon request.)

## CONCLUSIONS

From this study, the following conclusions were reached:

1. While no comparison group of learning-disabled students in a similar environment was available, it is apparent that important and significant improvement of a number of cognitive strategies takes place in the middle-school years with this sample population. These effects include concept formation, short-term memory, oral language production, analysis, synthesis, and the general reasoning skills associated with pattern recognition (the Ravens test).

2. The growth in the above strategies is impressive between the time of entry into the program in which Instrumental Enrichment is used and the end of their first year in the program; growth beyond that end-of-first-year level into a second year is minimal. However, the effects from the first year of improvement are generally sustained.
3. Students perceive that their own cognitive development is improving, as indicated by clear patterns in their self-assessment; in addition, the program appears to result in a heightened student awareness of their own thought processes.
4. Both teachers (on a group basis) and academic advisors ( on an individual student basis) are explicitly aware of student improvement in a variety of cognitive processes that are fundamental to problem-solving in different subject-matter contexts.
5. Teachers perceive that their own teaching style is changed as a result of using the program with students, in the direction of employing more explicit cognitive strategies and helping students to emphasize and become aware of cognitive processes.
6. The school-wide commitment to incorporating the program into every school day, in addition to encouraging teachers to use similar methodologies in the context of other subjects, is a clear facilitating factor in the apparent success of the program in terms of its positive effects on students.
7. The adaptation of the mediated learning approach of Instrumental Enrichment to the Meta Learning Program for students who are not yet ready for the paper-and-pencil exercises of IE resulted over the long term in similar, though not identical, the same effects as for students who only had the IE instruction per se. No claim is made that Mediated Learning alone is responsible for the changes noted.

8. A number of factors coincided across the years of intervention: the incorporation of Mediated Learning through daily instruction in Instrumental Enrichment, consistent use of the Feedback Awareness System with students, a longer-than-traditional school day, effective remediation of areas of specific deficits, content-based courses as opposed to a focus on only skills-based courses, certified and well-trained teaching staff, and a smaller-than-traditional teacher-student ratio.

9. Mediated learning through the Instrumental Enrichment approaches clearly is at least one important factor in obtaining observable, sustainable, and significant improvement in a variety of cognitive strategies for learning-disabled students as measured in three ways—objective cognitive measures with recognized standardized instruments, self-perception of one’s own abilities to carry out problem-solving, and the perception of students’ advisors in regard to students capabilities after the intervention.

## DISCUSSION

It is the task of a future study to sort out the key factors that contributed to the reported outcomes. Such an endeavor would ideally involve larger cohorts of students across several settings. One possible contribution that the current study could make to such an endeavor is the faculty-training component. Over the twenty years of the study, faculty-training remained consistent, with Mediated Learning as its centerpiece.

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**APPENDIX A: CHECKLIST FOR INDEPENDENCE**

Name: \_\_\_\_\_ Date: \_\_\_\_\_

### A Checklist for Independence \*

Rate yourself on each of the following items between 10 and 1.

**10** means you are perfect in this skill

**5** means that you use this skill half of the time

**3** means that you know the skill, but do not use it

**1** means that you do not have this skill

#### INPUT SKILLS

\_\_\_\_\_ I PREVIEW texts or notes before class.

\_\_\_\_\_ I WARM UP before class. I use \_\_\_\_\_ and \_\_\_\_\_

\_\_\_\_\_ I keep an AUDIT TRAIL by putting my name, the date, and the name of the class on each page.

\_\_\_\_\_ I INQUIRE, rather than sit back in the class.

\_\_\_\_\_ I ask for diagrams and outlines, or I make them myself.

(3 SENSE LEARNING.)

\_\_\_\_\_ I use tapes, visuals, models, or computer programs to review.

(3 SENSE LEARNING.)

\_\_\_\_\_ I find the important facts when reading or taking notes from lectures.  
(ANALYZING)

\_\_\_\_\_ I GATE. When I do not understand a word or sentence, or when I cannot keep up to what is being said, I raise my hand and ask the lecturer to repeat or explain.

\_\_\_\_\_ I choose 10 or fewer important thctcs. (PARSIMONY)

\_\_\_\_\_ I write new words on a VOCABULARY List.

\_\_\_\_\_ I study my VOCABULARY List daily, and in my spare time.

\_\_\_\_\_ I use a Plan Book. (TEMPORAL EFFICIENCY.)

\_\_\_\_\_ I write all of my homework in the Plan Book without being reminded.

(TEMPORAL EFFICIENCY.)

\_\_\_\_\_ I plan long-term assignments in orderly, efficient steps.

(TEMPORAL EFFICIENCY.)

\_\_\_\_\_ TOTAL (out of 140 possible points.)

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Rate yourself on each of the following items between 10 and 1.

**10** means you are perfect in this skill

**5** means that you use this skill half of the time

**3** means that you know the skill, but do not use it

**1** means that you do not have this skill

### **ELABORATION SKILLS**

\_\_\_\_\_ I clearly define each new problem. (PROBLEM SOLVING)

\_\_\_\_\_ I use a 7 Step Plan to solve difficult problems. (PROBLEM SOLVING)

\_\_\_\_\_ When Problem solving, I am not distracted by irrelevant information.

\_\_\_\_\_ When Problem solving, I work with the whole idea or task in my mind. I do not break it into little parts, then lose track. of what I am doing.

\_\_\_\_\_ I only start to solve the problem after I obtain all materials and information needed. (PROBLEM SOLVING.)

\_\_\_\_\_ I try alternate ways to solve tough problems, then ask for help if I still need it. (PROBLEM SOLVING.)

\_\_\_\_\_ I SYNTHESIZE facts into an organizing principle or Main Idea

\_\_\_\_\_ I CONTEXTUALIZE new words.

\_\_\_\_\_ I BRIDGE each new concept I learn, applying it in other areas of my life.

\_\_\_\_\_ I CLUSTER new words and concepts to help me understand them.

\_\_\_\_\_ I IMAGE new material.

\_\_\_\_\_ I MATRIX, connecting new words or facts to my previous learning in several ways.

\_\_\_\_\_ I INFERENCE the meaning of new words, then look them up. I INFERENCE the main idea of paragraphs in which it is not directly stated.

\_\_\_\_\_ I RESOURCE by looking up information I do not know.

\_\_\_\_\_ I SUMMATE at the end of each page of notes, or the end of a chapter or book.

\_\_\_\_\_ I TRANSFER skills I learn in one area to other areas.

\_\_\_\_\_ When I have my work corrected, I ANALYZE my ERRORS and learn what I must do to improve my product.

\_\_\_\_\_ I set appropriate GOALS for myself in learning situations.

\_\_\_\_\_ I complete two FLUENCIES daily in activities that require automaticity.

\_\_\_\_\_ I complete all of my HOMEWORK.

\_\_\_\_\_ I complete my HOMEWORK on time.

\_\_\_\_\_ I check my own work for correctness. (FEEDBACK)

\_\_\_\_\_ I use my mediator's or peers' comments as a guide toward improving.  
(FEEDBACK).

\_\_\_\_\_ TOTAL (*out of 240 possible points.*)

Rate yourself on each of the following items between 10 and 1.

**10** means you are perfect in this skill

**5** means that you use this skill half of the time

**3** means that you know the skill, but do not use it

**1** means that you do not have this skill

### **OUTPUT SKILLS**

#### Speaking Skills:

\_\_\_\_\_ I attempt to speak PRECISELY.

\_\_\_\_\_ I try to be ELOQUENT when speaking, by using parsimony, and  
choosing the correct words.

\_\_\_\_\_ I attempt to say my statements in an interesting way. (ELOCUTION)

#### Writing Skills:

\_\_\_\_\_ I write an OUTLINE before I write a paper.

\_\_\_\_\_ I make my sentences PRECISE.

\_\_\_\_\_ I TAKE NOTES by writing key facts, then adding to my notes after classes

\_\_\_\_\_ I SOLJDIFY my thinking by writing or saying a thought to make it clearer.

\_\_\_\_\_ I EDIT my work carefully.

\_\_\_\_\_ When corrected work is returned to me, I REPAIR any error I made.

#### Work Load:

\_\_\_\_\_ When work piles up, I problem-solve and plan a schedule to get it done.

\_\_\_\_\_ I keep cool under pressure.

\_\_\_\_\_ TOTAL (*out of 110 possible points*)

### OUTPUT QUANTITY

For the following questions, fill in the number of pages you can complete. (Maximum is 55.)

I can read and outline \_\_\_\_\_ pages of texts or reference works per day.

I can complete \_\_\_\_\_ pages of essays or reports per month

\_\_\_\_\_ TOTAL (*out of 11 possible points*)

My Independence Score:

\_\_\_\_\_ First Page (Input) Total (*140 possible points.*)

\_\_\_\_\_ Second Page (Elaboration) Total (*240 possible points.*)

\_\_\_\_\_ Third Page (Output) Total (*110 possible points.*)

\_\_\_\_\_ (Output Quantity) Total (*110 possible points.*)

\_\_\_\_\_ **Independence Score (the total of all of the pages) (600 possible points.)**