

Retraining Cognitive Abilities: A Report on Thinking and Memory Improvement Combining Suggestopedia with Cognitive Behavior Modification (CBM) for Ages 10 - 55

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Published Spring 1989, Journal of Accelerated Learning and Teaching

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Today's schools, along with their curriculum are criticized because the nation's standardized test scores in reading and mathematics have been falling since the 1960's. Many students avoid science and other demanding fields. This dilemma may not be a question of teacher incompetency, lack of school structure, or the incompleting teaching of world knowledge. It may not be a lack of student motivation, poor home support and values. While these are important detrimental considerations, additionally it could be a problem of poor information processing ability, or deficiencies in underlying cognitive thinking abilities.

Information processing problems exist in many learners, making classroom instruction a difficult task. Teachers and business supervisors are searching for answers to learning difficulties and inability to perform basic job skill functions. Individuals need to learn and process information, and to remember it, so that the classroom and work environment can become more productive and harmonious.

Programs aimed at teaching the basics of reading, writing, and arithmetic depend upon adequate information processing ability. Long-range benefits for individuals who improve their information processing capabilities include more entry opportunities for gainful employment, increased career options, and better performance on the job. This leads to opportunities for career advancement.

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Carefully designed Cognitive Behavior Modification (CBM) (Meichenbaum, 1977) techniques and strategies that included verbalization, mnemonic organization, and study skills still fell short of desired improvement of academics, because some important foundation components were missing. Theoreticians, although looking at all the ramifications of the problem, were not focusing on an important bottom line issue. This was poor information processing capability, with deficient cognitive functions.

Individuals, whether high or low achieving children, teenagers, or adults, are often born with certain underlying information processing deficits which do not disappear with maturation or the passing of time. These deficits may include inadequate visual and auditory sequential memory capability that ultimately interferes with the integration of information. Individuals possessing several of these problems, may develop some compensatory and coping skills. They often carry within them a high degree of stress that can result in underachievement, or even chronic situational depression. These deficiencies when existing within multiple cognitive functions, may be called learning disabilities, Dyslexia, or mentally handicapped. The problem may be misdiagnosed and blamed on a lack of motivation or poor attitude. Individuals may be told to try harder, or to seek help with counselors or mental health professionals. Wrong prognoses are often made. The thwarted individuals may not achieve to their maximum potential. They may not be able to enter the career fields of their choice, or be able to compete and advance in their chosen fields.

If mental abilities can be positively influenced, then we need to know what experiences will help individuals improve cognitively. This requires monitoring through standardized testing of the various cognitive abilities. According to Pellagrino (1985), many intellectual skills are malleable. Therefore, by ascertaining a person's strong and weak areas, carefully designed individualized instruction, as set forth in this study, can be applied to effect improvement.

Currently, an emphasis is being made by educators to teach to the proficient dominant learning style, whether it be visual, auditory or kinesthetic. Additionally, methodology is being

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designed to help learners function with strictly a global simultaneous approach. While this line of thinking holds merit, another consideration needs to be addressed. Why not correct or retrain the deficient learning style, or inability to function sequentially and analytically?

This study was undertaken to develop and document a different approach to improving mental functions and deficient learning styles. Learning capabilities were to be enhanced, through memory acquisition and retention. The study was designed to explore if low achieving individuals and also high achieving individuals, could improve their cognitive functions, within a wide age range from 10 to 55.

This experiment was comprised of a group of 40 experimental subjects selected from a pool of 140 experimental subjects who received the three week treatment, and 40 controls who did not receive treatment, to determine whether there was any interaction effects of the treatment with age and entry ability levels within the experimental group. Hypotheses were that subjects from a broad age, ranging from ages 10-55, of both fast and slow paces, would improve visual speed of perception, and auditory and visual sequential memory, leading to improved auditory and visual integration, and comprehension.

Techniques of elaborative short-term memory rehearsal of underlying abilities were used to realign and correct specific information processing deficiencies. Such procedures, as applied in this study, using strategies of decoding, sequencing, analysis, and visualization, are based on Cognitive Behavior Modification (CBM) principles (Meichenbaum, 1977), and the simultaneous vs sequential dichotomy (Kaufman & Kaufman, 1983), within Guilford's (1967) Structure of Intellect model. When combined with Suggestopedia (Lozanov, 1978), the intent was to explore the possibility of rapidly improving underlying thinking and memory skills, thereby resulting in better conceptualization, and improvement in academic aptitude or daily job proficiency.

Novel stimuli were used in the study. This included ventriloquist puppets and audio visual media, as adjuncts to Cognitive Behavior Modification and Suggestopedic techniques, in order to improve memory acquisition and retention.

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Method

Subjects

To serve as the experimental treatment group, a group of subjects consisting of forty individuals, both male and female, ages 10 to 55, and primarily from a middle income environment, was randomly selected from a pool of 140 individuals who had received the three week treatment. Another group of forty individuals, ages 10 to 55, selected outside of the group of 140 individuals were selected as the control group and matched the 40 E Ss in age and entry proficiency. All of the experimental and control subjects voluntarily participated in the study. The control group did not receive treatment between the two tests. Both groups represented a typical Bell Curve distribution of ability levels as determined by the initial screening assessment test scores. The individuals included business executives, general employees, housewives, and college, high school, junior high, and grade school students down to age 10. There were some learning disabled.

Class Grouping Procedures

Two to five individuals, according to age and entry ability levels, were placed in separate class groupings in the experimental treatment group. They were initially screened and tested using seven subtests of the Woodcock Johnson Psycho-Educational Battery (WJ) (Woodcock, R. & Johnson, M., 1977) and The Detroit Tests Of Learning Aptitude (DTLA-1) (Baker, H. & Leland, B. 1935; 1967), measuring spatial relationships and visual perceptual speed, auditory sequential memory, visual sequential memory and auditory-visual integration (See Tables 3 & 4). For the treatment application, high average to superior students were grouped together, average students were grouped with average, low average with low average, and moderate to severe deficit students were similarly grouped with one another. Every effort was made to make

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the treatment groupings compatible, by age and ability, so that the instructions and lessons could be geared and paced according to the overall compatibility of the individuals in the groupings.

The 40 Experimentals matched the 40 Controls in age and entry ability levels. Each group of 40 had 25 higher ability (fast pace) individuals, and 15 individuals of lower ability (slow pace). Each of these two groups were broken into ages 10 to 15 years, and 16 to adult. The 25 fast pace individuals had fifteen subjects ages 15 to adult, and ten subjects ages 10 to 15. The 15 slow pace individuals consisted of eight subjects ages 16 to adult, and seven subjects ages 10 to 15.

The ability level of each individual, for grouping placement requirements, was determined by the standardized tables and ability references of the Woodcock-Johnson Psycho-Educational Battery, which is ideally suited for matching and pairing students for experimental designs, as it identifies cognitive characteristics. It also has definite descriptions of each functioning level, which are: very superior, superior, high average, average, low average, moderate deficit, and severe deficit. Those subjects whose functioning level scores were average to very superior, including the perceptual speed cluster, were placed in the high ability (fast pace) groupings. Similarly, the subjects who had functioning level scores, including perceptual speed, of below average to severe deficit, were placed in the low ability groupings.

Suggestopedia Stimuli Applied

Part of the stimuli applied in the study with the treatment group, was the use of videoed life-sized ventriloquist puppets as a teaching tool within a suggestopedic design framework (Lozanov, 1978). The use of puppets as class models were for the following reasons:

1. The variety of vocal intonation, including pitch variations, tonal changes, and sound dynamics, of the puppets was designed to enhance visual and auditory memory (Lozanov, 1978; Render & Anderson, 1986). The puppets became an important tool in depicting the varying analytical sequence components, and also the simultaneous components (Erland, 1980).

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2. The animated and vocal characters were nonhuman figures that were implemented to help reduce stress surrounding the intensive drilling procedures.

3. The unusual cartoon faces formed a whole gestalt framework on the video screen and became a simultaneous memory aspect, and also in improving visual closure, which is processing as a whole gestalt formation (Kirk & Chalfant, 1984). Similarly, the individual faces depicted separate chunking formations, or sequencing instruction.

4. The puppets created a place of focus, attention, and concentration. They also became models (Bandura, 1971) in the drilling rehearsal paradigm (Erland, 1980).

5. The cartoon puppet figures were part of the Suggestopedic design to create a warm, close, stimulating environment, that can become conducive to learning and memory. (Erland, 1980).

Music, Rhythm, and Pacing

Other components applied in many of the instructional drills in the treatment groups were music, rhythm, timing, and pacing. A variety of music was used as simultaneous audio background mental pacing. The music timing ranged from largo and adagio, to andante, using a variety of classical, baroque, modern and jazz (Ostrander, & Schroeder, 1979). Tonal patterns, using musical chimes for counting multiple tone sequences, were also employed for contrasts in teaching auditory sequential memory. The chime tone was simultaneous in nature, and the sequential counting was successive in nature.

In many of the lessons a metronome was used to maintain mental pacing and an inner sense of rhythm and timing. The metronome was set at largo to adagio for exercises that needed a slower and more deliberate pace. It was set at allegro for exercises requiring a faster memorization rate.

Light and Color

Another component was the use of light and color in the teaching procedure. Coordination of light and color effects were an important part of the lessons. They were

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designed to stimulate simultaneous processing, and to inject a warm emotional feeling, to induce a more rapid learning process. (Frostig & Maslow, 1979). This included colored transparencies on an overhead projector, and pink lighting in the treatment classroom.

Video Recordings

Video recordings of the puppet characters were used as segments of the class training exercises. Each puppet was filmed with only the individual face showing on the screen at one time. Different wooden people-puppet faces, acting in sequence, were used to model various exercise segments. Therefore, with the puppets reciting individually in sequence, the complete learning segment is in concrete representational form, both vocally and visually. This visual and auditory format was designed to improve visual and auditory sequencing (successive processing) through chunking, and visual and auditory closure (simultaneous processing) through synthesis representation of the individual speaking face, thereby creating integration of the two.

Abilities and Academic Content

Abilities Content.

Six cognitive thinking ability functions were incorporated into the exercise drills. Each exercise drill consisted of six to nine steps. Each step shifted back and forth from spatial to linear, synthesis to analysis, encoding to decoding, visual to auditory closure patterns, and inductive to deductive reasoning (see Figure 1). Every exercise drill incorporated the following six cognitive thinking functions (shifting between simultaneous and successive processing) (Hatta, 1960; Kaufman & Kaufman 1983):

1. Spatial And Linear Relationships

Spatial skills, crucial in learning the concept of place value with digits, comparison of sets, rational counting, and general mathematical calculating, are coupled with linear placement (Luria, 1966; McLeod & Crump, 1978). Spatial abilities are correlated with success in geometry and algebra, handwriting, and in the career fields of engineering, architecture, photo journalism, and art and design. Pellegrino (1985) concludes that training and practice of cognitive abilities

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that include spatial skills can often lead to substantial thinking ability improvement that is reflected in standardized tests.

Linear cognitive thinking is reflected in visual and auditory sequential memory, which is the foundation for analysis or analytical thinking, including reading, mathematics, spelling, and written composition. (Das, Kirby & Jarman, 1979).

2. Synthesis And Analysis

Detailed exercise drilling of sequential information leads to rapid analytical ability. The synergistic shift from synthesis (parts to whole processing) to analysis (whole to parts processing) creates different interpretations of the same presented material (Kaufman & Kaufman, 1983). Identifying similarities and differences are an additional component (Piaget, 1950).

3. Encoding And Decoding

The ability to decode words phonetically is crucial to reading comprehension. The ultimate purpose of reading is to become aware of the thought units on a page without being aware of the individual letters and words (Katz & Wicklund, 1972; Laberge & Samuels, 1976; McClelland, 1976; Rumelhart, 1978b; Kirk & Chalfant, 1984). Written symbols must be decoded before they can be encoded into meaning. The ability to decode and encode is crucial to the learning of a foreign language (Liberman, Mattingly & Turvey, 1972), and according to Aristotle, for mathematical reasoning (Sternberg, 1985). Encoding is also a component of process execution, which is the underlying foundation for mathematics, and for understanding analogies which are an important component of many college examinations.

4. Visual And Auditory Closure

Exercises in closure are important underlying abilities for reading and oral communication (Elkind, 1970). According to Kirk & Chalfant (1984), closure may be defined as the recognition of a whole gestalt when one or more parts of the whole are missing. Students with poor auditory closure often have difficulty with reading, along with oral communication.

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This is evidenced by omission of words, confused word order, and substitution of words and word meaning. Students with poor visual closure have difficulty with whole gestalt interpretation, which can be reflected in reading and written language difficulties. (Kirk & Chalfant, 1984).

5. Inductive And Deductive Reasoning

Deductive reasoning is applied through exercises in logic and reasoning. Sternberg (1985) discusses a three-part reasoning plan which begins with understanding the problem, then devising a plan which consists of serial ordering, next executing the plan without error, and finally considering alternative methods that may exist. Piaget (1950), known for his work in mental logic and deduction, stresses the ability to draw valid conclusions. Inductive reasoning has been a central part of theories of intelligence, of which Thurstone (1938) was a forerunner. According to Sternberg (1985), all inductive reasoning has the same basic property, which is selecting and interpreting an appropriate continuation of a pattern that is presented to an individual.

6. Visual Imagery And Verbalization

Visual imagery (simultaneous processing) and verbalization (successive processing) are crucial components of thinking. Paivio (1971a) states that a dual-processing system, comprised of nonverbal imagery and oral symbolic processes, is the underlying foundation for memory and thinking. Each exercise drill in this study incorporated shifting from visualizing to verbalizing of the information. This is an important component of Cognitive Behavior Modification (Meichenbaum, 1977).

Academic Content

1. Sight Words And Reading

A series of unrelated sight words were drilled according to memory-span length (Miller, 1956, Magnuson, 1977). Sets of four can be gradually extended to sets of six or more (Bower, 1972a). They should be presented both visually and auditorially. This drilling procedure helped

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automatic short-term memory recall bridge to long-term memory recall (Spear, 1978).

Magnuson (1977) indicated that rehearsal of unrelated sight words improved reading comprehension of remedial 7th grade students.

There is a positive relationship between auditory memory, visual memory, and visual-auditory integration as important perceptual skills that is linked to reading achievement. (Kavale, 1981). Good short-term auditory memory processing is a determinant of reading speed (Jackson & McClelland, 1975).

Howard (1983) suggests three major processing differences between good and poor readers. They are: (1) the use of phonemic coding in working memory, (2) the capacity of working memory, and (3) the speed of encoding letters. Each of the drills in the study incorporated these functions.

Unrelated Letter Sequences were drilled as part of the reading speed and comprehension instruction, beginning with spans of six and progressing to spans of ten. (Craik & Lockhart, 1972; Jackson & McClelland, 1975; Fredriksen, 1977; Rumelhart, 1978; Howard, 1983).

The early stages of letter processing occur simultaneously, and the late stages of processing are successive (Hatta, 1980; Coles, 1987). This underlying feature level therefore requires rapid cognitive shifting from simultaneous to successive during reading. This inability to rapidly shift letters is a reading processing dysfunction associated with dyslexia (Thomson, 1984; Coles, 1987).

2. Vocabulary

Individual words from reading content were taught according to meaning inference, both in and out of context. Latin root-word derivatives were also drilled and learned. Reading comprehension and vocabulary skills correlate with intelligence. (Kavale, 1982; Sternberg, 1985).

3. Spelling

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Procedures for learning spelling words were taught according to scope and sequence (difficulty level progression) (see Figure 1). Emphasis was placed on attack, rehearsal, and long-term memory techniques. The spelling of each word was recited several times both forward and in reverse. This was designed to enhance visualization and placement value of the feature level components (Estes, 1975b).

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4. Math Facts

Developmental learning abilities involved in arithmetic and mathematical skills are: (1) problem solving, (2) concept formation, (3) language, (4) integration & association, (5) memory (auditory and visual), (6) discrimination (auditory and visual), and (7) attention (auditory and visual) (Kirk & Chalfant, 1984).

Poor visio-spatial skills result in difficulty in learning the concept of place value with digits. Individuals lacking these skills have difficulty with mathematical calculating (Piaget, 1950a; Luria, 1966; Coles, 1987).

5. Grammar And Composition

Written composition is an important part of the communication process. Sequential ordering and linear flow of short term memory becomes important to syntax and grammar organization, and is a problem with many learners, and with dyslexics (Kaufman & Kaufman, 1983; Thomson, 1984). The following sentence exercises in the study taught syntax and grammar: scrambled words to form sentences, repeating sentences word for word, and missing word completion.

6. Numerical Digits

Numerical digits were drilled starting with sequence spans of three and moving to spans of ten. Students learned concentration, attention, and mental manipulation of numerical placement by reciting the span first forward, then in reverse, and then forward again. This type of mental flexibility, including visualization of spatial placement, becomes an important skill for those engaged in accounting, typing, data and word processing, and statistical measurement. Thomson (1984) notes that dyslexics often do poorly on span tests, that require sequencing.

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7. Handwriting

Motoric output emphasizing hand-eye coordination was used whenever possible using Bandura's (1971) modeling framework within his Social Learning Theory. This included spatial versus linear flow construction or simultaneous vs successive processing (Kaufman & Kaufman, 1983).

Training Procedure

The training period for the treatment groups in Experiments I and II consisted of 15 sessions meeting for one hour and fifteen minutes daily, Monday through Friday, for 3 weeks. Six to seven different rapidly paced drills, representing various cognitive functions, from simultaneous to successive, were taught daily (Piaget, 1950a; Feuerstein, 1956; Guilford, 1967; Meeker, 1969; Das, Kirby, & Jarman, 1975a; Kaufman & Kaufman, 1983). A modeling and imitation paradigm was the basis for the rehearsal and drilling procedure used in presenting the nearly one hundred different exercise segments within the total drill areas (See Figure 1 for sample drill lesson content) (Bandura, 1971; Piaget, 1950). Initially the clinician verbally modeled the instruction, then the ventriloquist people-puppets verbally modeled the same instruction in sequence. Each puppet character took a part in the drill sequence on the video screen (Sharp, 1972). Each puppet offered its own variety of vocal pitch, ranging from high to low. The tonal quality, ranged from mellow to sharp, and the dynamics, ranged from loud to soft. Then a single puppet sang the entire sequence (a simultaneous application) with the treatment group overtly repeating the sequence in unison. These exercises formed a synergistic shift of the information, moving from simultaneous to sequential. The same single puppet then vocally recited the sequence one additional repetition (creating a whole gestalt) (Elkind, 1970), with the group again reciting in unison. The first peer model in the treatment group verbally modeled the same instruction. Then each of the other group members actively participated by verbally modeling the instruction. After the first three days, each member of the group stood and recited the training segment, maintaining eye contact with the other members of the group.

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Additional written motor performance repetition was administered whenever appropriate, offering multi-sensory integration (Bandura, 1971; Ayres, 1972).

The average time spent on each drill in the daily class framework was seven minutes. This short time frame was designed to stimulate the active attention of each student, and to create cognitive shifting from simultaneous to sequential. Each individual drill item was repeated once by the group members after the clinician modeled the item (Meichenbaum 1977; Brown & De Loache, 1978). Coinciding with the models on the television monitor, it was repeated eight times, and then once independently by each group member, i.e., a total of ten overt repetitions per individual. Each group member was instructed to focus on the reciting member and covertly rehearse the item simultaneously. This added an additional four repetitions, or a total of fourteen repetitions per individual. Each drill consisted of roughly three to four different items, thereby providing fifty-six repetitions per individual during each drill. These fifty-six repetitions, times the seven to eight different drills, totaled nearly 400 repetitions in continuous drilling, per one hour and fifteen minutes session. Memory traces are strengthened through repetition (Spear, 1978). According to neurobiologist Lynch (1984), memory traces are created by repeated firings of the neuronal synapses in the brain. This creates chemicals that in turn ensures that the circuit will work more easily in the future.

The drills were paced according to the total ability level of the group. The scope, sequence, and difficulty level of the drills were maintained (Johnson & Myklebust, 1967; Salvia & Ysseldyke, 1981). Low ability students often required more drilling per item than did the students in the higher ability groups. The drills were presented until the responses became automatic. After the eighth day, cues and prompts were faded (Skinner, 1953; Sloan, 1980). The initial modeling of the puppets on the television monitor was decreased to two times for the average to superior groups. The slower groups decreased repetitions after the eleventh day to three times. The students were carefully advanced from their base levels of cognitive performance, and paced to higher, more complex cognitive levels (Johnson & Myklebust, 1967).

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Exercises trended during the treatment period from concrete to more abstract concepts (Piaget, 1950a; Sloan, 1980).

All drills were taught in units or blocks of trials (Skinner, 1953; Sloan, 1980). Every sequence drill was broken down into small components (Myklebust, 1965; Salvia & Ysseldyke, 1981), which were drilled commensurate with each individual's memory span length (Miller, 1956).

Some drills were designed not only to reflect an individual's memory-span length, but also for complexity levels involving interrelationships of information schema. The drills were given in successive approximations (Johnson & Myklebust, 1967; Siegel, 1972; Sloan, 1980; Salvia & Ysseldyke, 1981). Each learner's response was carefully monitored by the clinician (Meichenbaum, 1977; Sloan, 1980; Kirk & Chalfant, 1984). The removal of cues and stimuli was carefully planned according to the spontaneity of learning by the individual students (Skinner, 1953; Meichenbaum, 1977; Sloan, 1980).

Each drill included decoding wholes to parts, and encoding parts to wholes (Piaget, 1950a; Feuerstein, 1956; Bower, 1972a). The intensive application in every drill of decoding and encoding, analysis and synthesis (Estes, 1972a; Sternberg, 1985f), contributed to the process of overlearning (see Figure 1).

The exercise drills were specifically designed to switch back and forth between simultaneous and successive processing. This was in order to encompass the entire thinking process and to include all thinking abilities (Kaufman & Kaufman, 1983). Therefore, students favoring one or the other style of processing soon become engaged in, and comfortable with, both cognitive styles. Each drill exercise included several sequential component properties and as several simultaneous component properties. Therefore, a synergistic mental cognitive shift was activated within the individual (Hatta, 1960).

Various exercises in Suggestopedic imagery and visualization (Paivio, 1971; Bower, 1972) were introduced and implemented along with reauditorization and verbalization (Meichenbaum, 1977; Sloan, 1980). These were combined with the sequence training rehearsal procedures (Hynd & Cohen, 1983). Self-instructional strategies, which are a part of CBM procedures, were taught (Meichenbaum 1977). They included the shaping of verbalization from overt speech to covert speech. Each learner was also instructed in the self-monitoring of internalized thinking (Brown & De Loache, 1978), which included linear sequential analytical thought patterns (Sternberg, 1985).

Cognitive thinking strategies of encoding, word association, and clustering of parts, and their application in the drills, were carefully explained to the students. The various drills incorporated each of these memory strategies (Kirk & Chalfant, 1984). They identified and analyzed specific patterns and configurations, and interacted by discussing problem-solving solutions (Piaget, 1950; Estes, 1972; Kosslyn & Pomerantz, 1977). The various interpretations were discussed among the peers and a consensus was reached. The seemingly best strategy was then coded and rehearsed.

Results

Table 1. Comparison of Pre and Post Course Test Scores for Two Test Samples (Ages 10 - Adult) on the Woodcock-Johnson Psychological Educational Battery

| <u>Auditory Memory</u> | <u>140 E</u> | <u>40 E</u> | <u>40 C</u> |
|-------------------------------|--------------|-------------|-------------|
| "Post" median score % | 94 | 93 | 71 |
| "Pre" median score % | 57 | 55 | 57 |
| Improvement Gain over control | 23 | 24 | -- |
| Stanine Improvement | +2.07 | +3.30 | +4.45 |
| <u>Visual Memory</u> | | | |
| "Post" median score % | 85 | 80 | 73 |
| "Pre" median score % | 61 | 58 | 64 |
| Improvement Gain | 24 | 22 | 09 |
| Improvement Gain over control | 15 | 13 | -- |
| Stanine Improvement | +1.96 | +1.70 | +7.70 |

*140 E: 140 Experimental Subjects (Total Pool Group)
 40 E: 40 Experimental Subjects (Randomly Chosen From Pool)
 40 C: 40 Control Subjects

Table 2. Multivariate Analysis of Covariance Using 7 Dependent Variables

| | <u>Wilks Lambda</u> | <u>F Ratio</u> |
|--------------------|---------------------|----------------|
| Group 1 E v C | 0.24 | 26.55* |
| Pace 2 | 0.87 | 1.29 |
| Age 3 | 0.80 | 2.16 |
| Group x Pace | 0.91 | 0.81 |
| Group x Age | 0.92 | 0.70 |
| Pace x Age | 0.91 | 0.86 |
| Group x Pace x Age | 0.86 | 1.42 |

* $df = 7,59$, $p < .01$

The seven dependent variables from the Woodcock-Johnson Psycho-Educational Battery (WJ) and the Detroit Tests of Learning Aptitude (DTLA-1) were:

WJ No. 02 Spatial Relations
WJ No. 07 Number Matching
WJ No. 03 Memory For Sentences
WJ No. 10 Number Reversals
DTLA-1 No. 06 Memory For Unrelated Words
DTLA-1 No. 16 Memory For Letters
DTLA-1 No. 18 Following Oral Directions

* * * * * * * * *

Results

Table 1 is a comparison of the 140 experimentals, 40 experimentals and 40 controls in Experiment I, comparing gains made in auditory and visual memory as measured by the Woodcock-Johnson Psycho-Educational Battery. Median percentile scores on each of the four subtests of the Woodcock Johnson Psycho-Educational Battery were higher for the treatment group, as well as the total pool group scores, when compared with controls.

Table 2 shows for Experiment I a 2(group: experimental vs control) x 2(ability or pace: fast vs slow) x 2(age:10-15 vs 16-adult) multivariate analysis of covariance (MANCOVA), conducted on seven scales (dependent variables). The 40 Es matched the 40 Cs in age and entry ability levels. Each group of 40 had 25 higher ability (fast pace) individuals, and 15 lower ability (slow pace). Each of these two groups were broken into ages 10 to 15 years, and 16 to adult. The 25 fast pace had fifteen individuals ages 15 to adult, and ten individuals ages 10 to 15. The 15 slow pace individuals were broken into eight individuals ages 16 to adult, and seven individuals ages 10 to 15.

Further analysis was conducted to discover whether differences on specific subtests were statistically significant. Independent variables were age (under 15/over 15), pace (fast/slow), and group (experimental/control). The scores on the pre tests were the covariates. Dependent measures were the post test scores. There was a significant overall main effect for group 1, (experimental vs control) $F=26.55$, $p<01$. There were no significant main effects for age or pace. None of the interaction effects were significant.

Table 3 for Experiment I shows the univariate analyses of covariance for each subtest, and summarizes the treatment effects on the 7 dependent variables. The analyses revealed significant main effects for all subtests except subtest No. 07 (Visual Number Matching).

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Table 3. Summaries of the Univariate Analyses of Covariance of the Treatment Effects on the 7 Dependent Variables

| <u>Subtest #</u> | <u>Treatment Mean Square</u> | <u>Mean Square Error</u> | <u>F</u> |
|--|------------------------------|--------------------------|----------|
| <u>WJ</u> | | | |
| Post 02 Spatial Relations | 158.20 | 16.10 | 9.31* |
| Post 07 Number Matching | 4.96 | 3.54 | 1.40 |
| Post 03 Memory for Sentences | 27.38 | 2.10 | 13.07* |
| Post 10 Number Reversals | 242.81 | 5.72 | 42.48* |
| <u>DTLA-1</u> | | | |
| Post 06 Memory for Words | 753.20 | 10.71 | 70.31* |
| Post 16 Memory for Letters | 138.19 | 4.24 | 32.56* |
| Post 18 Auditory-Visual Integration. Oral Direction Sequences | 2,813.81 | 28.19 | 99.82* |

* All tests significant at $p < .01$ except # 07.

Table 4 for Experiment I is a technical summary of a Table of Means. It shows the unadjusted and adjusted post test means for the experimental and control groups on each of the seven dependent variables. Standard deviations and maximum possible scores are also shown. When adjusted, the pre test to post test means had more points and the groups gained relatively more. In every case, the adjusted mean was higher for the experimental group than for the control group. With the exception of subtest No. 07, the differences between experimental and control group adjusted post test means is significant at the $<.05$ level.

Table 4.
Table of Means

| | | Total Possible Raw Pts. | Unadjusted Means | S.D. | Adjusted Post-test Means |
|--|---------|----------------------------|---------------------|------|--------------------------------|
| WJ #2 Spatial Designs Timed 3 Min. | E Pre | 74 | 47.88 | 7.73 | 52.57 |
| | E Post | | 52.85 | 7.15 | |
| | C Pre 1 | | 48.03 | 6.49 | |
| | C Pre 2 | | 50.50 | 6.03 | |
| WJ #7 No.Match Visual Timed 2 Min. | E Pre | 30 | 21.82 | 3.05 | 23.59 |
| | E Post | | 23.65 | 3.01 | |
| | C Pre 1 | | 21.72 | 2.48 | |
| | C Pre 2 | | 22.80 | 2.50 | |
| WJ #3 Sentence Repetition Auditory | E Pre | 22 | 14.75 | 1.92 | 16.62 |
| | E Post | | 16.72 | 2.00 | |
| | C Pre 1 | | 15.53 | 1.94 | |
| | C Pre 2 | | 15.82 | 2.19 | |
| WJ #10 Oral No. Reversals Auditory | E Pre | 21 | 8.05 | 3.12 | 14.01 |
| | E Post | | 13.65 | 3.11 | |
| | C Pre 1 | | 9.90 | 3.97 | |
| | C Pre 2 | | 10.60 | 4.04 | |
| DTLA-1 #6 Auditory Word Sequences | E Pre | 70 | 50.22 | 6.65 | 58.70 |
| | E Post | | 58.42 | 5.03 | |
| | C Pre 1 | | 50.45 | 7.32 | |
| | C Pre 2 | | 52.57 | 6.59 | |
| DTLA-1 #16 Visual Letter Sequences | E Pre | 20 | 12.78 | 2.86 | 16.97 |
| | E Post | | 16.75 | 2.91 | |
| | C Pre 1 | | 12.55 | 2.85 | |
| | C Pre 2 | | 14.00 | 3.21 | |
| DTLA-1 #18 Auditory- Visual Integration Oral Direction Sequences | E Pre | 40 | 14.18 | 6.06 | 29.60 |
| | E Post | | 29.85 | 7.72 | |
| | C Pre 1 | | 14.95 | 5.17 | |
| | C Pre 2 | | 17.62 | 6.21 | |

Footnote: 40 Experimental Subjects = E
40 Control Subjects = C

*Difference between experimental and control group adjusted posttest means is significant at the .05 level or less.

Discussion

A wealth of literature exists regarding the principles of Cognitive Behavior Modification (CBM). Meichenbaum (1977), usually recognized as one of the first in the development of CBM, combined the theories of Bandura (Social Learning Theory, 1971), Piaget (The Psychology of Intelligence, 1950), and Skinner (Theory of Behavior Modification, 1953). Many of the familiar components of the above three theories were implemented in this study. This included peer modeling (Bandura, 1971; Piaget, 1950); the shaping of behavior through graphing, positive reinforcement, arranging for a high percentage of correct responses and task analysis (Skinner, 1953; Siegel, 1972); and teaching from simple to complex concepts through gradient steps (Piaget, 1950; Skinner, 1953; Meichenbaum, 1977; Flavell, 1979; Sloan, 1980).

CBM, combined with Kaufman & Kaufman's Sequential-Simultaneous Dichotomy, along with Suggestopedia teaching principles, (Lozanov, 1978), within the Guilford Structure Of Intellect (1967) model, is a diverse yet compatible system for rapidly improving cognitive abilities and memory retention.

Successive processing refers to the processing of information in linear sequential order according to temporal context and cues. In this training system, rehearsal strategies are given to help implement the linear order. Simultaneous processing refers to the processing of information as one entire whole gestalt with spatial overtones. Auditory reasoning is successive, and visually presented reasoning is simultaneous (Das, Kirby & Jarman, 1979; Kaufman & Kaufman, 1983).

Authorities generally agree that the ability to place various components of information into sequential order is the underlying foundation for reading, mathematical computation, spelling, written composition, and computer programming (Meeker, 1969; Das, Kirby, & Jarman, 1979; Kaufman & Kaufman, 1983). There are basic sequential mental steps applied in inductive reasoning ability (Piaget, 1950; Meeker, 1969; Sternberg, 1985).

Suggestopedic procedures include an initial relaxation stage progressing into a more rapid accelerated learning phase (Lozanov, 1978). This includes vocal intonation for rapid memorization of passages, musical rhythm, timing, and color. Suggestopedic techniques when combined with sequential short term memory drilling, can be effective in enhancing memory abilities (Render, G. & Anderson, L., 1986).

Many experts in the fields of cognitive psychology and education have moved in the direction of the training of thinking ability and intelligence. Meichenbaum (1977) states that how to think is as important as what to think. Hirsch (1988) discusses the lack of world knowledge, or cultural literacy. Without good production capability, evaluative critical thinking ability suffers (Ruggiero, 1988).

The general population has more subtle brain damage, or dysfunction that result in information processing problems, than once was thought (Silver, et al., 1976).

Standardized subtests on the Woodcock-Johnson Psycho-Educational Battery (WJ) (Woodcock & Johnson, 1977; Woodcock, 1978)) and the Detroit Tests of Learning Aptitude (DTLA-1) (Baker & Leland, 1935, 1967; Hammill, 1985) can measure specific areas of cognitive functioning in the individual in a progressive fashion. Before these tests were developed, cognitive processes were often difficult to study in isolation (Flavell, 1979).

Some authorities (Hammill & Larsen, 1974; Torgeson, 1979) state that deficiencies in basic processing do not affect performance. Their criticisms were directed to the development of remedial programs correcting the deficiencies of psycholinguistic skills as assessed on the Illinois Test of Psycholinguistic Abilities (ITPA) (Kirk, McCarthy, & Kirk, 1968). Minskoff (1975) countered that Hammill and Larsen's study was not done with learning disabled or reading disabled students as the ITPA originally intended, and that there were many procedural errors, including: not accounting for group versus individual treatment, not having carefully

designed and controlled strategies and techniques, no length of time involvement, and no accounting for teacher competency and assessment errors.

Other remedial programs and systems emerged, and many are still continuing, that trained the underlying cognitive abilities (Piaget, 1950a; Feuerstein, 1956; Meeker, 1969; and Frostig & Maslow, 1979). These definitive component ability frameworks began with Thurstone's (1938) Seven Primary Mental Abilities, and were followed by Guilford's (1967) Cognitive Model of 150 abilities. Meeker (1969) isolated 26 abilities for testing and training from this model.

Gardner (1985) discussed how many authorities abandoned parallel and information processing theory "bottom up" in the late 1970's. This was because the lack of follow-up statistics, and evidence that retraining processes had generalization effects. Hirsch (1988) agreed with Gardner that a "top down" consciousness of schemata functions is necessary for comprehension and memory.

Individual learners have strengths and weaknesses within their underlying cognitive processing abilities (Kirk, McCarthy & Kirk, 1968). These underlying abilities can be trained so that academic success is facilitated (Piaget, 1950a; Feuerstein, 1956; Meeker, 1969; Frostig & Maslow 1979). Requirements for implementing access to these abilities are: good short-term recall, serial recall, cross-modal coding ability, memory scanning, encoding, and depth of processing ability (Farnham-Diggory & Gregg, 1975). Primary mental abilities are not statistically independent but are intercorrelated with each other. Therefore, individuals who tend to be high in one ability are high in other intercorrelated abilities, and those individuals who are low in one ability, tend to be low in other abilities (Sternberg, 1985).

It is not intended to show an application of the ITPA per se, but that the deficiencies in the underlying abilities of visual and auditory sequential memory can be corrected and improved.

This is accomplished through unique encoding control strategies with elaborative rehearsal, leading to improvement of long-term memory retention, and ultimately, conceptualization of information.

This study demonstrates that cognitive behavioral and Suggestopedic techniques used to aid memory drilling can be effective in enhancing memory abilities. That scores were increased on general tests of ability, rather than on mere memory tasks, suggests that underlying cognitive components were enhanced through memory rehearsal. All subjects in the treatment group, regardless of age or ability levels, improved their performance significantly in these underlying abilities. This includes: visual and auditory perception, discrimination, closure, sequential memory, and integration.

Teaching specific strategies and techniques of self-instruction, with an intensive and consecutive daily format, can affect both high and low ability learners positively. This is regardless of age, and offers a higher level of mental organization. Therefore, retention and higher order conceptualization are improved.

The application of novel stimuli appeared to increase the learner's attention and concentration, and aided in absorption ability. It was designed to assist in contributing to a warm, emotionally supportive and less stressful environment, which can lead to improvement of overall short-and long-term memory.

This research has both theoretical and practical implications. From theoretical point of view, it demonstrates that CBM techniques can be expanded upon. Underlying processing abilities can be addressed by identifying weaknesses and systematically correcting them. One practical implication for education, because of the maintenance of training results as indicated in one to three year post testing, is that consideration should be given to implementing these drilling methods and cognitive strategies, both in schools and in the work place.

The ability to understand and assimilate CBM metacognition strategies depend upon the individual's information processing ability. Therefore, individuals with either deficient visual or auditory processing ability, or with deficiencies in both abilities, cannot accurately assimilate teaching strategies, or instructional procedures on the job. Efficient information processing, which includes both visual and auditory sequential memory ability and encoding capabilities, is essential if the student is to be able to follow lectures and classroom instruction, read and recall technical textbook information, and have the mental organization necessary for successful test-taking. These processing abilities are also important to the individual on the job, in the areas of rapid reading comprehension, satisfactory oral and written communication capabilities, following procedures and job skill functions, and good reasoning and problem-solving capabilities. To achieve optimal results in an academic or work environment, processing abilities need to be drilled simultaneously with instruction of learning strategies. This ultimately enhances critical thinking capability.

Conclusion

Present and new methods using Cognitive Behavior Modification and Suggestopedia applications should be researched and studied as they may apply to the improvement of learning ability and intelligence.

Different approaches and theory combinations are often ignored because they do not fall into the parameters of usual solutions. Luchins (1942) outlined the phenomenon of functional fixedness as the way customary uses to which a material are used can inhibit an individual from perceiving how to use that same material implemented in a novel way in order to solve a problem (Gardner, 1985).

Researchers, school and business administrators, and classroom teachers will have to be open-minded and adjust to new teaching concepts and methods, and be willing to re-evaluate their priorities, in order to produce effective and efficient learning programs. Cognitive Behavior Modification and Suggestopedic procedures will remain in the theoretical domain, unless procedures like those used in this study are adopted by school districts and private clinics.

Parents need to take more responsibility in supervising their children's academic progress, as well to encourage their schools to adopt new teaching methods. Improved learning and intelligence is an interrelated responsibility of students, parents, teachers, school and business administrators, and researchers.

The next SALT issue will include the second part of this report, that contains longitudinal one to three year posttest follow-up data of this method.

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