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The effects of language development on the generalizability of self-instruction training

Ferrigno, George A., Ph.D.

City University of New York, 1989

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The Effects of Language Development on the Generalizability of Self-Instruction Training

by

George Ferrigno

A dissertation submitted to the Graduate Faculty in Educational Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

1989

This manuscript has been read and accepted for the Graduate Faculty in Educational Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

1/25/89
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Introduction

Psychologists have long been concerned with developing and implementing strategies that will help children learn, integrate, incorporate, and generalize treatment methodologies. There has been considerable research outlining heuristics for aiding the generalizability of problem solving strategies (Borkowski & Cavenaugh, 1979; Brown, 1978; Gagne, 1968; Greeno, 1979; Newell, 1979; Paris & Oka, 1986). In recent years, cognitive behavioral self-instruction techniques have proven effective in aiding the student to focus, direct, adapt, and implement problem-solving methodology through a series of self-mediating, self-regulatory statements (Kendall & Wilcox, 1980; Meichenbaum & Goodman, 1971; O'Leary & Dubey, 1979). The present research extends this work by examining two issues: 1) the efficacy of self-instruction training at different levels of language development and the effects of training on the relationship between language ability and cognitive tempo; and 2) the importance of the active rehearsal component of the self-instruction procedure.

While self-instruction interventions have proven effective in modifying a number of behaviors (Burgio, Whitman, & Johnson, 1980; Palkes, Stewart, & Kahana, 1968; Robins, Armel, & O'Leary, 1975) and with various populations (Genshaft & Hirt, 1980; Leon & Pepe, 1983; Swanson, 1985), several authors have noted that evidence for generalization has been equivocal (Fish & Pervan, 1985; Meichenbaum &

Asarnow, 1979; O'Leary & Dubey, 1979). Significant results have been demonstrated with those populations who have exhibited deficient performance in a number of test taking and problem-solving situations (Meichenbaum, 1977; Schunk & Rice, 1983; Snyder & White, 1979).

The self-instruction intervention has undoubtedly been helpful in altering the responding of impulsive children's problem-solving approaches (Bornstein & Quevillon 1979; Camp, Bloom, Herbert, & van Doorninck, 1977) particularly on psychometric tests most adversely effected by impulsive responding (Kendall & Finch 1976; Palkes, Stewart, & Freedman, 1971). Other reseachers have noted that cognitively impulsive children are deficient in the use of verbal mediational strategies but demonstrate the ability to profit from induced verbal mediational training in modifying their cognitive tempo (Weithorn & Kagan, 1978, 1979, 1984). Some studies have focused on and demonstrated the effects of self-instruction training on more academically oriented tasks (Bryant & Budd, 1982; Douglas, Parry, Morton, & Garson, 1976; Schunk & Rice, 1983) and with nondysfunctional "regular" children (Schleser, Cohen, Meyers, & Rodick, 1984; Schleser, Meyers, & Cohen, 1981). Those studies that yielded results have been inconsistent and not overwhelming in terms of generalization (Friedling & O'Leary, 1979; Meichenbaum & Asarnow, 1979; Nichol, Cohen, Meyers & Schleser 1982). It is apparent, however, that treatment works better with certain children and with certain behaviors that optimize their abilities and problem-solving strategies.

Numerous researchers have noted that the failure to achieve

consistent generalization findings may be due to the failure to consider the limitations and the characteristics of the subject being studied (Copeland, 1981; Hobbs, Moguin, Tyroler, & Lahey, 1980; O'Leary & Dubey, 1979). Results from a number of studies indicated differential effects for age in planning the type of self-instruction strategy (Kendall & Wilcox, 1980; Mischel & Patterson, 1976). It was indicated that younger children require more concrete and explicit language and instructions while older children could make use of more abstract general instructions (Copeland & Hammill, 1981; Toner & Smith, 1977; Wasserman, 1983). As age is an inexact measure of cognitive ability, reseachers began to consider the cognitive maturity and the cognitive developmental level of the child in developing the optimal strategy for a particular child (Cohen, Schleser, & Meyers, 1981; Ferrigno, Wasserman, & Fish, 1985; Schleser, Meyers, Cohen, & Thackwray, 1983). While results were promising, generalization effects were limited and the particular aspect(s) of cognitive developmental level responsible for generalization were not clearly delineated and/or camoflouged by the group data and the statistical methodology used (Copeland, 1981). Numerous researchers especially those investigating subject variables in the use of self-instruction training have noted that the language developmental level and the verbal ability of the child may be a contributing factor in maximizing cognitive self-instruction training (Copeland, 1981; Copeland & Hammill, 1981; Schunk & Rice, 1983). This idea is consistent with and inherent in the theory underlying self-instruction methodology (Bem, 1970; Luria, 1961; Meichenbaum &

Goodman, 1969; Reese, 1962; Vygotsky, 1962) as well as inferred in the self-instruction research (Douglas et. al., 1976; Schleser et. al., 1984; Snyder & White, 1979).

The idea and origins of self instruction strategies are derived from the developmental works of Vygotsky (1962) and Luria (1961) who emphasized the interrelationship of thought and language and its effects on development. They hypothesized that aspects of speech, particularly 'internal speech', develop, control, and help regulate behavior. They also note that language develops over time, initially being more concrete and literal and gradually becoming more complex and conceptual. This coincides with the findings in the self-instruction literature which indicate that younger children perform best with specific instructions and older children perform better with more general ones. Vygotsky (1978) noted that while a child may develop and use words in establishing mutual understanding with adults, it is a gradual process before he/she reaches the level of concept development characteristic of fully developed thought and the language of adults. Failure to consider this aspect may be the critical variable of the failure of many self-instruction programs in consistently achieving generalization effects. Developmentally, the child may not be at the language level where he/she is capable of generalizing the training to other situations and tasks.

The present study investigates the effects of language development on the ability of children to generalize self-instruction training. It further investigates the generalization of self-instruction training along the impulsive-reflective dimension

with non-dysfunctional, regular grade children. It compares the effects of a general-content self-instructional strategy with a didactically presented general problem-solving approach to determine the relative effectiveness of the self-regulatory, active rehearsal components incorporated in the self-instructional package. The study attempts to demonstrate that children with higher levels of language development and verbal proficiency are more capable of generalizing a semantically based intervention such as self-instruction training. Language development and verbal ability are evaluated based on childrens' performance on the TOLD-I, the Test of Language Development-Intermediate, (Hammill & Newcomer, 1971). In order to try to demonstrate that children with an impulsive cognitive style benefit most from self-instruction training, impulsivity-reflectivity was evaluated using the MFFT, Matching Familiar Figures Test (Kagan, 1966). The generalized dependent measure is based on children's performance on the Peabody Indivlualized Achievement Test (PIAT) (Dunn & Markwardt, 1970), and the specific dependent measure is the children's performance on the Specific Training Test (STT). Data will be analyzed using a multiple regression analysis in determining the relative contribution of the continuous aptitudes of language development and impulsivity as well as the categorical treatment variable on the criterion.

Related Problem Solving Literature

The development of a learning strategy that helps individuals transfer what they learn in one situation, produce, adapt, and utilize it effectively in another situation, has been investigated extensively. A shared concern in both the cognitive-behavioral and problem solving literature has been the issue of generalization, and findings have been equivocal. In reviewing the problem solving literature, one consistent question has been whether general problem solving can be taught.

Various researchers have emphasized different aspects of a strategy which contribute to its generalizability. Borkowski and Cavanough (1979) list what they consider requisite skills for strategy generalization. Their list includes the following: 1) identify a strategy that is operative in different situations and know when and how to apply it, 2) train the instructional package so that there are common elements between training and generalization contexts, 3) develop, through the use of self-instructional procedures, search routines that encourage the child to analyze a task, scan his/her available strategies repertoire, match it to the demands of the task, and finally 4) reinforce successful functioning. Similarly, Brown (1978) proposed four problem-solving steps: 1) analyze and characterize the problem at hand, 2) check strategies necessary for a solution, 3) devise a plan to attack the problem, and

4) check and monitor progress. Brown et. al. (1977) stated that rather than teaching a large number of specific routines and some extremely general ones, an alternative approach would be to identify and teach intermediate level skills or packages of skills. She notes that an excellent example of such development comes from the cognitive behavior modifiers such as Meichenbaum (1977), who have concentrated on the general methods.

While the strategies and processes outlined by Brown (1978) are regarded as metacognitive processes which essentially refer to "knowing" about ones' cognitions and the 'ability to control' these cognitions, parallel development has taken place in cognitive-behavior modification whereby children learn to use cognitive strategies. Cognitive behavioral literature has similarly focused on the need for task analysis or what Meichenbaum (1977) has called a cognitive-functional analysis of children. His method emphasizes the role of the subject's cognitions, and a functional analysis of the subject's thinking process with a focus on the subject's cognitive strategies related to task parameters. Although the origins for these parallel and at times convergent viewpoints are different, the current literature on how to effectively teach problem-solving skills has many overlapping and congruent aspects.

Paris and Jacobs (1984) note that general problem-solving skills and higher order thinking skills have become synonymous with metacognition. They go on to state that the enthusiasm for metacognition is popular because it is usually considered to be general knowledge that transcends particular tasks and situations and

it emphasizes trans-situational problem-solving skills. Paris and Lindauer (1982) state that metacognition can serve to guide one's actions and self-management of cognitive resources. While pointing out that metacognitions may arise spontaneously by introspection and reflection, they can also be stimulated directly by someone else. Individual metacognitive differences provide a reference point for assessing instructional needs so that monitoring, self questioning, and revising a plan can be taught to children who do not ordinarily use these skills. Paris also noted that learning is mediated by various cognitive activities such as directions, questions, and organizers and these cognitive activities can help mediate academic activities. Brown (1978) included predicting, planning and reality testing as comprising metacognitive processes. These cognitive functions are those that Meichenbaum (1977) has underscored in his development of cognitive training strategies.

These findings on problem-solving strategies lend support and credence to the Meichenbaum cognitive-self-instructional strategies. The basic premise and focus of his strategy was to provide a self-instruction statement that would help the child reflect on the presenting problem, thereby controlling and inhibiting an impulsive response and providing the child with a strategy for attacking the problem and reaching a viable solution within his/her capabilities and repertoire.

Developmental Origins of Self-instruction Training

The origin of self-instructions was based on the developmental theorizing and research conducted by Soviet psychologists Vygotsky (1962) and Luria (1961) who suggested a progression from external to internal control of cognitive self-speech in regulating behavior. The goal of the Meichenbaum studies was to demonstrate Vygotsky's (1962) contention that internalization of verbal commands is the critical step in the child's development of voluntary control of his/her behavior.

Vygotsky (1962) hypothesized that cognitive development is the process of gradually transferring externally imposed control to internally controlled behavior through the development of speech. Initially, the child is physically linked to his/her mother when in the womb, biologically dependent on her during infancy, and later socially and emotionally bound up with her; first directly, then later through speech. By these means the child enlarges his/her experiences and acquires new modes of behavior developing new ways of organizing his/her mental activities. By naming various surrounding objects and giving the child orders and instructions, the mother shapes the child's behavior. Having observed the objects named by the mother, after acquiring the faculty of speech, the child begins to name them actively and thus to organize acts of perceptions and deliberate attention. The child learns to formulate ideas and intentions independently first in externalized and then in inner

speech, thus creating deliberate activity. What he/she could do previously only with an adult's help, he/she is now able to do unassisted.

Vygotsky (1962) states that inner speech develops through a slow accumulation of functional and structural changes. It branches off from the child's external speech simultaneously with the differentiation of the social, speech for others, and egocentric, self-directing, functions of speech. This private speech was seen as thought spoken by the child out-loud and its purpose is to communicate with the self for self-guidance and self direction. He believed that private speech helped to develop thought through its role in organizing behavior.

Similarly, Luria (1961) hypothesized that behavior control is dictated by the development of speech and proposed a three step model for language development. Initially, the child is directed by others' speech, later the child comes to rely on self-instruction on an overt level. Finally, speech is internalized and covert speech acts as the controlling agent orienting his/her behavior. This private speech is an important means through which children organize, understand, and gain control over their behavior. Initially, a child performs in response to the command of an adult and then he/she begins to use external speech, at first in conjunction with the act and later preceding it. Finally, this external speech is condensed and becomes internalized. It becomes the inner speech which takes over the function of regulating behavior. During the pre-school years, the child's external speech becomes less overt and more covert, gaining

more control over behavior.

Luria (1961) suggested that language gains control over motor behavior in the following stages: (1) initiating stage (2) inhibitory stage (3) regulatory stage. The child becomes capable of actively modifying the environment that influences him/her by using speech for himself/herself, altering the relative strength of the stimuli acting upon him/her, and adopting his/her behavior accordingly. Luria notes that the readjusting of mental processes under the influences of speech do not happen suddenly but are the products of a long process of development. The child under two years of age is not able to use speech to direct his/her own behavior. The speech of others serves to initiate, direct, and control the child. As the child progresses, speech helps initiate motor behavior, but will not inhibit it regardless of the semantic content of the speech. It is only in the final stage that the semantic content of the child's speech becomes dominant, directive, and internalized. During this stage of development, internal speech or thought serves to permit analysis and self-regulated behavior.

Vygotsky (1962) states that his investigations show that speech development follows the same course and obeys the same laws as the development of all other mental operations involving the use of signs. "This formation of internal speech, which is closely bound up with thought, leads to a new, specifically human, stage of development. The verbal analysis of the situation begins to play an important role in the establishment of new connections; the child orients himself to the given signals with the help of the rules he

has verbally formulated for himself; this abstracting and generalizing function of speech mediates the stimuli acting upon the child and turns the process of elaboration of temporary connections into the complex, highest self-regulating system" (Luria, 1961, p.96). It is through the development of both thought and speech that a child becomes more capable of understanding and incorporating knowledge of the world.

There remains a constant interaction between outer speech and inner mental operations, one form effortlessly and frequently changing into the other and back again. Vygotsky gives the example of thought and speech as two intersecting circles. In their overlapping parts, thought and speech coincide to produce what is called verbal thought. He pointed out that verbal thought does not by any means include all forms of thought or all forms of speech. There is a vast area of thought that has no direct relation to speech. The roots and developmental course of the intellect differ from those of speech in that initially thought is non-verbal and speech non-intellectual. At a certain point the two lines of development meet, speech becomming more rational and thought more verbal.

In line with Luria (1961) and Vygotsky's theory (1962), Meichenbaum and Goodman (1969a) proposed a similar three-stage treatment procedure in which the initation and inhibition of voluntary motor behaviors come under verbal control. Meichenbaum presents three levels of controlling speech: overt-adult, overt-child, covert-child. He hypothesized that inadequate performances in new learning situations might be improved through

cognitively mediated terms through both verbal and imaginal means. He characterized inadequate task performances of children to be related to differences at any one or a combination of the following stages: a) a child may not comprehend the nature of the problem or task and thus cannot discover what mediators to produce - what Bem (1971) called a "comprehension" deficiency; b) a child may have the correct mediators within his repertoire but fail to spontaneously and appropriately produce them - what Flavell et. al. (1966) called a "production" deficiency; c) the mediators which the child produces may not guide his/her on going behavior - what Reese (1962) called a "mediational" deficiency.

Bem (1970) stated that when a child experiences problem solving difficulties on tasks that are sufficiently complex, the question of what to produce becomes explicitly problematic. For a large class of problems, discovering what to produce, or discovering a strategy is contingent on comprehending the structure of the problem. The individual usually cannot develop a stategy for a problem solution unless he/she has some representation of the desired outcome. Bem underscored the importance of the comprehension component in problem solving, and also suggested that in certain linguistically loaded tasks language maturity may play a role in the comprehension process. While Bem emphasized the importance of comprehension in problem-solving, other reseachers focused on other aspects in the problem-solving process.

Flavell (1966) stated that the young child may fail to produce those words or instructons which could serve as potential mediators

of his/her task behavior. The problem is not that his/her verbalizations have insufficient mediating or regulating power, but rather that he/she does not spontaneously produce relevant verbalizations in the first place. He concluded that the failures of a young child to produce adequate verbalizations may reflect an immaturity that is specifically linguistic in nature. He goes on to state that there may be more to language development than just a gradual mastery of its phonology, morphology, and syntax. "The child who has language may still not know exactly when and where to use what he has in the same way that an individual may have a concept or cognitive rule and yet not think to apply it on every appropriate occasion. While children learn to translate linguistic competence into verbal utterance in a number of contexts, he may not have learned to do this in all appropriate contexts" (Flavell, et.al., 1966, p.296). While Flavell stressed the importance of production in the problem-solving procedure, other researchers noted the role that mediational deficits play in problem-solving.

Reese (1962) noted that an inability on the part of the young child to mediate or regulate his/her task behavior verbally, despite his/her ability to understand and to use the relevant words, is a mediational deficit. Reese noted that there is a deficiency in mediation in young children compared to older children and he concluded that in some cases the deficiency may be characteristic of an early stage of development and of an earlier stage of concept formation. The discrepancy between linguistic and mediational capacities gets reduced and the mediation deficiency tends to

disappear with age. While all three authors focus on different aspects of the cognitive mediational process, they all emphasize a language developmental continuum along which the child becomes more capable of applying the appropriate component.

This three stage cognitive mediational process of comprehension, production, and mediation led to Meichenbaum and Goodman's (1971) self-instructional training package which essentially teaches children to talk to themselves. The training regimen was designed to teach children to engage in mediating responses that exemplified a general strategy for controlling behavior under various circumstances. The package attempted to teach children how to (a) comprehend the task (b) spontaneously produce mediators and strategies and (c) use such mediators to guide, monitor, and control their performances. This self-instructional package which has been widely adopted in subsequent research includes a five-step procedure: 1) cognitive modeling: adult tells child what to do while performing a task, 2) overt guidance: child performs under the direction of adult instruction, 3) overt self-guidance: child performs while instructing himself/herself aloud, 4) faded overt self-guidance: child whispers instructions while performing tasks, 5) overt self-istruction: child performs task while guided by inner silent speech. Through the five-step procedure, the child would have observed as well as demonstrated several performances of relevant skills such as defining the problem, focusing attention and response guidance, self-reinforcement, and self-evaluative coping skills and error correcting options. The focus of the training is not what to think but how to think (Meichenbaum & Asarnow, 1979).

Self-instruction Research

Meichenbaum and Goodman (1969a) laid the groundwork for self-instruction training when they investigated the developmental control of verbal operants over motor responses. Fifty-four kindergarten and thirty first grade children were randomly assigned to one of three groups with a verbal operant condition to tap "faster" or "slower." The verbal operant conditions were: E verbalized the operant, S said the operant aloud, or S whispered the operant. Results indicated an interaction between age and mode of delivery in controlling motor behavior. Kindergarten children performed better in the overt condition while the first graders did better in the covert condition. The authors concluded that there is a developmental sequence of a functional interaction between covert speech and motor behavior. One of the implications of the study was that instructional procedures employed with children consider the child's optimal level of self-verbalization. This initial study led to further research in verbal control over voluntary motor behavior eventually leading to the seminal work in self-instruction procedures.

Meichenbaum and Goodman (1971) investigated the effects of self-instruction (SI) training on impulsive second grade children in their performance on five dependent measures: Porteus Maze performance, prorated WISC Performance IQ, MFFT, classroom

observations, and teaching ratings. Fifteen children were randomly divided into one of three treatment groups. One group was the cognitive training group whose training involved four, half hour treatment sessions over a two-week period. The other two groups were controls; one received attention, meeting with the experimenter the same amount of time but receiving no SI training, and the other group didn't meet with the experimenter but was given pre and post tests only. Results indicated that the group receiving SI training improved significantly on three of the measures including the MFFT (a measure of cognitive impulsivity), Porteus Maze performace, and the prorated performance IQ of the WISC-R. The results did emphasize that for impulsive children SI training can alter their impulsive cognitive style effecting their performance on a number of problem-solving tasks. While treatment effects were observed on the dependent measure, these effects did not generalize to the classroom. These results questioned the efficacy of SI training in facilitating generalization beyond the treatment setting.

Other researchers have also studied the effects of self-directed verbal commands on hyperactive, impulsive children. Palkes, Stewart, and Kahana (1968) studied maze performance of twenty hyperactive boys with a mean age of nine years old. The dependent measure was performance on the Porteus Mazes. A one-hour per day training for two days, using self-directed general format verbal commands, produced significant improvement in maze performance over a no-treatment control group. The authors concluded that the modification of behavior with self-directed command training effected a significant

change in qualitative scores on the mazes although no assessment of generalization to the classroom was reported. In a follow-up study, Palkes, Stewart, and Freedman (1971) investigated whether the vocalizations or the visual presentation of the command were responsible for the significant effects of their 1968 study. Thirty middle class normal intelligence, hyperactive boys with a mean age of 9.9 were assigned to one of three groups: a verbal training, a silent reading, and a no training group. Results indicated that the verbal training group did better than both groups. The improvement was not demonstrated at a two-week follow-up. The authors concluded that the vocalization of external mediators is the primary determinant for temporary establishment of self-control over voluntary behavior. While self-directed verbal commands have proven effective in helping hyperactive and impulsive children control their impulsive responding, the studies have not consistently demonstrated generalization effects.

Other reseachers investigating the effects of SI training on impulsivity have reported significant effects for a decrease in impulsive responding with substantial evidence for generalization. Kendall and Finch (1976) in a single-subject, multiple-baseline design investigated the effects of SI training with one hyperactive-impulsive child. Results indicated improvement on the MFFT which was sustained at a six month follow-up administration. In a follow-up group comparison study, Kendall and Finch (1978) investigated the effects of verbal self-instructions with response cost contingencies to a control group with twenty children identified

as impulsive based on their performance on the MFFT. Results indicated improved performance on the MFFT and on teacher ratings of impulsivity which was maintained at the three month follow-up. The results of these studies have demonstrated the effects of SI training in the altering of the response pattern of impulsive and hyperactive children.

Other researchers have studied the effects of impulsivity on problem-solving behaviors noting that impulsive children may not attend, rehearse, and employ effective performance self-regulatory strategies. Over the past years there has been a growing body of literature that has focused on the relationship between reflection and impulsivity and problem solving behaviors. Kagan (1966) has noted that the reflection-impulsivity dimension referred to as cognitive tempo, is influential in a number of the problem-solving phases. He notes that impulsive children display difficulty in carrying out all phases of problem-solving and tend to perform less accurately on reading tasks (Kagan, 1965), and serial learning tasks (Kagan, 1966), stating that this tendency to be reflective or impulsive shows intraindividual stability over time and generality across situations. Kagan (1966) used the Matching Familiar Figures Test (MFFT) to discriminate between children who respond quickly with many errors and children who show longer latencies but fewer errors. Children who respond slowly, with few errors are referred to as reflective while those with short latencies and high error rates are labelled impulsive. Welthorn and Kagan (1978, 1979, 1984) conducted a series

of studies investigating the interaction of language maturity and verbal mediation on the performance of high activity level and cognitively impulsive children. They state that high language development in an otherwise impulsive high activity child might enable the lengthening of attention span on tasks that are facilitated by verbal mediation.

Weithorn and Kagan (1978) compared the performance of high activity level first graders who displayed impulsivity and short attention spans with classmates of low activity level with better concentration. Estimates of school functioning and performance on a perceptual-motor and a visual matching test were examined as a function of activity level and language maturity. Results indicated superior performance with the low activity level students on the relevant measures studied. A significant interaction effect was found between activity level and language development with improved performance a direct function of language maturity. They concluded that high language maturity can be an important factor in the performance of high-active children enabling them to function well despite their behavioral impulsivity. They further stated that children of high language maturity, regardless of activity level, attended longer to the task, and thus produced fewer errors than children of low language maturity. These findings are compatible with the notion put forth by Luria (1962) which emphasizes the role of language development in the inhibition of non-verbal motoric responses. It also emphasizes the role that language maturity and verbal mediation plays in problem solving situations facilitating the

focus of attention in a cognitively impulsive child.

With prior studies suggesting that language development plays an important role in control of impulsive responding, Weithorn and Kagan (1979) investigated the effects of verbal mediation on impulsive, high active first graders. A major focus of the study was to point out that in some children an impulsive response style and failure to use language to mediate responses may result in poor performance. Results indicated that the high-activity level children with low language maturity reduced their errors on post-test measures with verbal mediated training. They concluded that for high-active level children, training in verbal self-regulation is an important and useful technique.

Weithorn and Kagan (1984) investigated the relationship between verbal mediation and high-active cognitively impulsive school-aged children. Ninety second-graders were assessed for activity level, using a teacher's rating scale, and cognitive impulsivity using the Matching Familiar Figures Test. The findings strongly suggest that cognitively impulsive children are deficient in the use of verbal mediational strategies, but they demonstrated an ability to profit from induced verbal mediational strategies. They concluded that the interrelationship of language, mediation, and impulsivity may change across the developmental spectrum and that cognitive training in verbal mediation is a logically sound, educationally feasible intervention. This intervention appears particularly potent for the child who has a short attention span and who is not yet at the stage of language development where he/she can mediate responses

internally, whereby impulsivity may govern the response pattern. While results from selected research on impulsive children and the research on self-instruction training have demonstrated effectiveness on improving performance on psychometric measures, mazes, and MFFT performance other studies have focused on altering responses to more academically oriented behaviors and tasks.

Self-Instruction Research: Academic Tasks

Researchers investigating the effects of self-instruction training on academic tasks continued to utilize populations that were impulsive or dysfunctional in their problem-solving approaches. Bryant and Budd (1982) investigated the effects of SI training on the classroom performance of three impulsive pre-school children. Using a multiple-baseline design across subjects, they measured rates of independent on-task behavior. The training material consisted of naturalistic task worksheets rather than psychometric test items which the authors felt contributed to the relevance and generalization of the SI package. SI training resulted in improved levels of on-task performance and increased levels of accuracy on worksheets that were similar to those that were used in training. Findings point to the generalization of SI training when tasks are highly similar to those trained for with impulsive pre-school children over a relatively short period of training.

Similarly, Bornstein and Quevillon (1976) investigated the effects of a self-instructional package on three overactive

pre-school boys, by using a multiple-baseline design across subjects with on-task performance as the dependent variable. Results indicated that on-task performance increased concomittant with the introduction of the SI package. Training effects were proported to have transferred from the experimental tasks to the classroom as well as being maintained over a three month period. In a follow-up investigation, Friedling and O'Leary (1979) failed to replicate the results of the Bornstein and Quevillon (1976) study. Second and third grade hyperactive children were used and training was similar to the same five stage faded rehearsal procedure as Bornstein and Quevillon. Friedling and O'Leary's (1979) results did not replicate Bornstein and Quevillon's (1976) findings except that the experimental group showed improved accuracy on Easy Math problems used during training but no systematic changes were observed on other measures nor was any generalization reported.

While SI research has proven effective in modifying the responses of children defined as impulsive and hyperactive on psychometric measures, evidence for generalization to other more academically oriented tasks remains mixed. One consistent theme of many of the researchers, however, is that SI training is most effective with those children who exhibit difficulties in problem-solving and other test taking situations as with the impulsive-hyperactive child, and with children who display other deficiencies effecting their performance.

In line with this theory, Swanson (1985) investigated the effects of self-instruction training on emotionally disturbed childrens'

academic performance in two experiments. In the first experiment, a thirteen-year old hearing impaired youngster received self-instruction training for nine sessions in a single subject multiple baseline design across tasks. Dependent measures were reading comprehension based on his performance on the Scientific Research Associates (SRA) Corrective Reading Series and spelling performance based on words derived from the Merrill Linguistic Readers and Barbe and Dolch Word List. Results indicated improved academic performance on both reading and spelling measures with authors noting generalization to new tasks and maintenance of training. In a second experiment, Swanson investigated the effects of self-instruction training of academic performance of three educationally-handicapped youngsters. A multiple-baseline procedure across subjects was used with dependent measures of math improvement based on the subject's performace on the math series, "Arithmetic Step By Step," and spelling improvement assessed similarly as in experiment one. Results indicated improved math and spelling performance with the introduction of self-instruction training. Generalization was noted on those tasks that were highly similar to those in training as was found by Friedling and O'Leary (1979) where similar age grade children were used.

Genshaft and Hirt (1980) studied the effectiveness of self-instructional training to enhance math achievement in females who were identified as underachieving in math. Subjects were thirty-six seventh grade girls who were performing below grade level in math. Subjects were randomly assigned to one of three groups:

Group I received tutoring, Group II received tutoring and training in self-instruction based on procedures developed by Meichenbaum and Goodman (1971) following a general problem-solving format, and Group III was a no-treatment control who received neither tutoring nor self-instruction. Pre and post measures from the Stanford Diagnostic Mathematics Test were used. Results indicated an overall increase in math performance for tutoring and self-instruction groups over the no-treatment groups, although a significant difference between groups I and II was not initially seen. Analysis of subtests on the Stanford revealed significant group differences in favor of the self-instruction group for both computation and application. Authors attributed the gains of the self-instruction group to a reduction of anxiety although no direct measures of subject's anxiety was obtained. They concluded that SI training may be benefical to children in a variety of academic contexts in which they underachieve. No assessment of generalizability to their regular classroom performance was conducted.

In another study investigating academic improvement, Robin, Armel, and O'Leary (1975) investigated the effects of self-instruction on the writing deficiencies of thirty kindergarten children. Subjects were assigned to one of three groups: self-instruction, utilizing the self instruction package outlined by Meichenbaum and Goodman (1971), direct training program (consisting of feedback and reinforcement) and a no-treatment control. Training consisted of twenty individual sessions three times a week over a seven-week period. Results indicated that the self-instruction group

proved superior to direct training while both treatments proved superior to no-treatment. A generalization task utilizing novel letters as compared to the training letters revealed no differences between any of the three groups for generalization. These results are similar to those found in the Meichenbaum and Goodman (1971) study which produced significant improvement in the self-instruction group over a control group for a simple motor behavior but no response generalization. Poor response generalization may be attributible to the subject characteristics in that they were too young, not cognitively mature enough, to generalize the training to tasks other than those used in training, whereas in the Genshaft and Hirt (1980) study, the seventh graders were adequately able to utilize the general instructions.

Limited generalization findings were obtained in studies that investigated SI training with other than "normal intelligence" youngsters who demonstrate cognitive immaturity. Burgio, Whitman, and Johnson (1980) studied the effects of SI training on two highly distractible retarded children, ages 9 and 11, in increasing their attending behavior. Results indicated a decrease in off-task behavior during math and printing but no reliable changes in academic performance were observed. The students were able to maintain and transfer learning to the classroom but only for the specific behavior for which they were trained. Limited response generalization may be attributible to the cognitive limitations of the subjects who are unable to generalize and transfer learning readily. In another study with cognitively limited children, Leon and Pepe (1983) investigated

the effects of SI training for the remediation of arithmetic deficits with twenty-four educable mentally retarded and twelve learning disabled youngsters between the ages of 9 and 12. They were randomly assigned to either a SI training or a control group. Pre and post test comparisons on the Key Math Diagnostic Test revealed that the SI group performed significantly better than the control group. Generalization, as measured by improved performance on modules not trained for, was obtained for the SI group but only on those problems that required similar computational skills again noting limited generalization with less cognitively mature children. These findings were similar to those of Bryant and Budd (1982), Swanson (1985), and Friedling and O'Leary (1979) who noted generalization to those tasks similar to those used in training. This finding is consistent with the literature in problem-solving (Borkowski & Cavenaugh, 1979) which noted that generalization is more likely to occur when more common elements exist between training and the outcome measures.

Generalization to tasks similar to those trained for was also found in a study by Douglas, Parry, Morton, and Garson (1976) who addressed the effects of SI training in approaching academic problems, cognitive tasks, and social situations. Eighteen hyperactive boys ranging in age from six to eleven years old were distributed into either a SI training or a control group with training consisting of twenty-four sessions over a three month period. . The trained group significantly improved on several measures including the MFFT, oral and listening comprehension on the Durrell Analysis of Reading, realistic and coping responses on story

completion, and the time measure of the Bender Gestalt. Other measures approached significance including Porteus Mazes and memory for unrelated words. Generalization from training tasks to other measures was noted but greater statistical significance was achieved on those skills incorporated although not taught during training. Authors attributed some of the success to encouraging the child to "verbalize strategies in his/her own words", thereby making the verbalizations more meaningful and compatible to his/her own language.

In a study with language deficient youngsters, Schunk and Rice (1984) investigated the effects of strategy self-verbalization on performance on a listening comprehension task. Forty-two children with language deficiencies in grades two through four were assigned to one of two groups: a strategy self-verbalization group or a control group. They received training for two thirty minute sessions for four consecutive weeks. Language deficient children were determined by performance of one year below grade level on the IOWA Test of Basic Skills. The dependent measure was performance on the SRA Achievement Series Listening Comprehension Tasks. Results indicated that both third and fourth graders in the strategy-verbalization group performed significantly better than the control groups but the second graders did not. The authors concluded that the task was too demanding for the second graders given the language deficiencies and their developmental level. They state that because of the developmental status of the child, the second graders may not have been able to internalize and make use of the strategies

as did the older subjects. They concluded that children who possessed listening comprehension deficiencies showed improvements in achievement in a short period of time and that strategy-verbalization techniques should be applied to other language competencies to determine it as an effective adjunct to instructional procedures to enhance and improve childrens' achievement outcomes.

Although self-instruction interventions with children have been successfully used to remediate a variety of problems, concern continues to be expressed over the inconsistent findings of generalization effects (Meichenbaum & Asarnow, 1979). In a review article on self-control procedures, O'Leary and Dubey (1979) note that generalization of training did not occur when training was conducted on a very restrictive range of tasks with specific instructions. They further state that one characteristic that facilitates generalization of self-instructions is the non-specificity of the instructional package. Results from Palkes, Stewart ad Kahana (1968) indicated generalization when a general self-instuction sequence was used such as "Look and think before I answer;" whereas Robins, Armel and O'Leary (1975) found no generalization when self-instructions were task specific.

Patterson and Mischel (1976), and Mischel and Patterson (1976) emphasized the importance of considering the substantive and structural elements of different self-instructional plans. They underscored the importance of the verbal content of the self-instruction in trying to delineate a more effective generalized self-instruction plan. In a more recent study, Kendall and Wilcox

(1980) investigated the content of self-instructional training on controlling impulsivity. Thirty-three, eight to twelve year old non-self-controlled children were randomly assigned to one of three groups. The groups were: concrete self-instructional training, worded to apply specifically to a task; conceptual self-instructional, worded more globally and abstractly so that they could apply to a wide range of situations; and an attention-placebo control group. Dependent measures were MFFT, Porteus Mazes, Impulsive Control Categorization Instrument, Conners' Teacher Rating Scale, Self-Control in Children Rating Scale, and the Hyperactivity Scale. Training consisted of six, thirty to forty-minute sessions over a three week period. Results indicated that treatment effects were greater for the conceptual training group than for the concrete training group. Performance measures improved for all subjects and while self-report data showed no improvement, the blind ratings of teachers on measures of self-control and hyperactivity indicated the desired change. The authors pointed out the efficacy that self-instruction training had on self-control and that the conceptual treatment strategy provided additional potency for generalization of training effects. As children aged 8-12 were randomly assigned, no age by treatment interaction was reported.

Similarly, Camp, Bloom, Herbert, and van Doorninck (1977) investigated the effects of a general self-instruction program enitled "Think Aloud" with 6-8 year old aggressive boys. A general strategy was used and concentrated on developing answers to the four basic questions: What is my problem, what is my plan, am I using my

plan, and how did I do?. Three groups were selected: an experimental self-instruction group; and two control groups, one aggressive, and one normal. The treatment group received daily 30 minute sessions for six weeks. Dependent measures included selected performance subtests from the WISC-R, The Wide Range Achievement Test (WRAT), auditory reception from the ITPA, the MFFT, and an Interpersonal Problem Solving Test. Results indicated treatment group performance was signficantly improved over the control group for mazes and the MFFT score. Reading achievement, prorated Performance IQ, and social speech scores showed a trend toward the predicted differences. Although some of the scores contributing to the discriminant score involved activities similar to those used in training, some such as the WRAT did not. This suggests the effectiveness of providing a general strategy as well as tasks similar to those used in training to enhance generalization. The idea of providing a broad problem-solving approach is consistent with the findings from problem-solving literature which similarly note that providing a more general strategy is more apt to foster generalization.

Results from a number of studies also suggest that certain instructions appear more suited for certain groups than others. It showed that younger less cognitively mature children were better able to use more concrete and specific instructions, and older more cognitively mature youngsters were able to benefit from more abstract, broad problem-solving approaches. Since it is rare that one wishes to teach a very specific skill in isolation, the idea of teaching general problem-solving procedures and the type of child who

can benefit most from that type of intervention remains a prominent concern for reseachers.

Generalization of Self-Instruction: Developmental Considerations

Varying the content of the self-instructional package has produced positive results, but the extent and application of these procedures has been limited and has resulted in varied degrees of success. O'Leary and Dubey (1979) pointed out the importance of determining characteristics of the child that interact with the effectiveness of self-control procedures in developing methodologies for teaching children to control their own behavior. Hobbs, Moguin, Tyroler, and Lahey (1980), in their review article on cognitive-behavioral therapy with children indicated that the failure of the various investigations to yield consistent findings on treatment effects may be attributed to methodological and subject limitations. Similarly, Copeland (1981) in a review article on subject variables in self-instruction programs notes the lack of attention to individual differences in response to self-instruction training.

Initially, age was considered as one of the subject limitations that inhibited generalization. Toner and Smith (1977) investigated the relationship between cognitive strategies and age on voluntary delay. A similar study by Miller, Weinstein, and Karnoil (1978) also investigated the differential effects of overt verbalizations and age

on delay behavior and concluded that older children may be spontaneously employing covert strategies to facilitate delay behavior. Both studies suggested a developmental trend in the ability to use covert strateges that facilitate behavioral change. Hartig and Kanfer (1973), in investigating the effects of varying the content of self-instruction training with 275 children, concluded that older children used the self-instructions more and that successful training in childrens' self-control may be more closely related to the availability of various verbal and other controlling mechanisms than to age. Other investigators began to look at developmental considerations that may effect the generalization of self-instruction training since age is such an inexact measure of cognitive ability.

Wasserman (1983) proposed a relationship between the effectiveness of cognitive-behavioral interventions along a cognitive developmental continuum. He hypothesized that Meichenbaum's techniques would be useful only for young children in training on highly specific tasks. He further hypothesized that the ability to generalize this training would not happen until higher levels of cognitive development were obtained. This theoretical paper highlighted many of the findings of the SI literature that treatment should be geared for and adapted to the subject employing the strategy. Furthermore, younger less cognitively mature children are able to benefit most from concrete explicit instructions while older, cognitively more mature children are able to utilize more general, abstract problem-solving approaches that lends itself to greater generalized effects.

In a preliminary study of a series determining the effects of cognitive developmental level and content of self-instructions, Schlesser, Meyers, and Cohen (1981) investigated the effects of general versus specific content, active rehearsal, and cognitive level (Piagetian defined) on the generalization of self-instruction training. Subjects were seventy pre-operational and seventy concrete operational "normal" second and third graders. Cognitive level was based on children's performance on conservation tasks, conservation of number, and conservation of continuous quantity. Children were then randomly divided into one of the five instructional groups:

1) Specific self-instructions - designed to provide an optimal strategy for a specific task.

2)General self-instructions - designed to provide a broad problem-solving strategy. Both specific and general self-instruction groups received Meichenbaum and Goodman's (1971) faded rehearsal procedure.

3) Specific didactic control - content that was identical to the specific self-instruction package but without active rehearsal and self-reinforcing statements.

4) General didactic control - content identical to general self-instruction package without the active rehearsal and self-reinforcing statements.

5) No-training control - met with examiner the same amount of time but verbal statements were irrelevant to tasks.

The dependent measures used consisted of pre and post test performance on the Matching Familiar Figures Test (MFFT), and on a

perceptual perspective taking task, the generalization measure. Results indicated that the specific self-instruction group performed better on the specific training task (MFFT) but that the general self-instruction group performed better on the generalization task. This finding suggests that generalization should be greater for those self-instructional interventions which provide more general problem solving strategies. The influence of Piagetian-stage membership proved insignificant for response to training, although it was useful in predicting absolute levels. These findings are important in that the results were similar to those studies that employed SI with students who displayed deficient performances, whereas this study used children who were deemed as overall "average". Findings indicate that within the range of average ability, there are differences in responses that can be modified with verbal mediational strategy training.

In a similar study, Cohen, Schleser, and Meyers (1981) investigated the effects of cognitive level and active rehearsal of self-instruction training. The study examined the efficacy of self-instruction training for different Piagetian defined cognitive levels and the importance of the active rehearsal component of the self-instruction procedure. Sixty same-aged nondysfunctional children identified as pre-operational or concrete-operational were divided into three groups: a no-training condition, a content only control group, and a self-instruction group with active rehearsal. Three sessions were conducted with all children with the first and last sessions also used as testing for pre and post-test performance on

the MFFT. Results indicated that the influence of training was similar for both cognitive groups with no significant cognitive developmental differences. The results did indicate significant changes for the self-instruction group emphasizing the effects of SI training on normal children along the reflective-impulsive dimension with a very short training period.

In a study specifically looking for generalization of self-instruction training, Nichol, Cohen, Meyers, and Schleser (1982) investigated the effects of cognitive level, Piagetian defined, and a directed discovery procedure on transfer of self-instruction training. Forty-eight pre-operational and concrete operational first and second graders were divided into two groups: a no-training control group and a group that received general content self-instructions delivered through a directed discovery procedure. Pre and post test measures were obtained on a training task (MFFT), and on a generalization task (perceptual perspective taking test). Results indicated that both pre-operational and concrete operational children in the self-instruction group improved significantly on the training task. On the generalzation task only the concrete operational children in the directed discovery group performed significantly better following instructions. This suggests that when children are given the opportunity to be an active participant and use their own language in defining a task and developing a plan, they perform better.

Similar findings were demonstrated by Snyder and White (1979) when they allowed behaviorally disturbed adolescents to adapt the

self-instructions to include their own language and inflections resulting in improved performance on a number of generalized measures not trained for. Douglas et. al (1976) also attributed some of their success in achieving generalization to the fact that they encouraged the child to "put into his own words" the self-instruction strategy. These effects underscore the importance of the compatibility between the language of self-instructions and the language of the child. Other authors (Bem, 1970 ; Flavell, 1966; Hartig & Kanfer, 1973; Reese, 1962) have noted similar findings in the ability of children to verbally mediate and influence their own behavior, which may be linked to the language maturity and other linguistic and verbal controlling mechanisms of the individual.

In a highly similar study, Schleser et. al. (1984) again compared the effects of cognitive level and training procedures on the generalization of self-instructions. In this study, pre-operational and concrete operational "normal" first and second graders performed on a training task, the Matching Familiar Figures Test (MFFT) and a generalization task (a perceptual perspective taking test) prior to and after serving in one of four self-instructional groups varying in the delivery procedures of the instructions. The instruction groups were a no-training control group, a didactic instruction control group, a fading self-instruction group, and a directed discovery self-instruction group. Children in the didactic instructions group received the same instructional content as the children in the "fading" and the

"discovery" group but without the active rehearsal. Children in the fading group received the traditional overt-to-covert rehearsal while the discovery group was led to "discover" the instructions through a dialogue with the trainer. Results indicated that the children in the SI groups significantly improved their performance relative to the control groups. Only the concrete-operational children in the discovery SI group demonstrated significant improvement on the generalization task. These results are similar to those of prior studies that found that children who are more cognitively mature benefitted more from a general conceptual problem-solving strategy. It further highlights the greater effects of providing a SI strategy that is compatible with the subject employing it as with the discovery group rather than having the trainer provide the general strategy.

A study by Schlesser, Meyers, Cohen and Thackway (1983) again compared the effects of a directed discovery procedure, a task-specific self-instruction group, general problem-solving self-instructions group, and a didactic control group to more academic, achievement oriented tasks. Children ranged in age between eight and ten years and were selected by teachers as exhibiting a "problematic lack of self-control". Forty-eight children were randomly assigned to one of the four training conditions and all children received forty-five minute training sessions one per week for four weeks. Pre and post test measures of the PIAT, WISC-R, and MFFT were administered. A training task of math problems and quizzes was utilized during treatment sessions. Results indicated that

children in the directed discovery and specific fading condition performed better on the training task and on the PIAT math subtest than children in the didactic control condition. While children in the general fading group demonstrated gains on the Spelling and General Information subtests and on total PIAT scores, discovery-trained children showed the broadest range of generalization improving on the Spelling, Reading Recognition, General Information subtests and on total PIAT scores. Results of this study underscore the importance of providing a general problem solving self-instruction strategy. It points out the integral function that active rehearsal and modeling has in the delivery of a problem solving strategy resulting in achievement gains with only four training sessions over a four week period. While the gains between the general fading group and the directed discovery group were not significantly different, they did point to better generalizability when the language for the self-instructions came from the children and was more compatible to the subject, and not provided, but guided by the examiner.

This series of studies suggests that children who are cognitively more mature benefit more from a general self-instruction package in the ability to generalize self-instruction training. What the specific dimension of this greater cognitive maturity is, is not clear but appears to be the compatibility between the language of the instruction and the subject's ability to use it. Copeland and Hammell (1981) in investigating subject variables in cognitive-self-instruction training also note that cognitively more

more mature individuals profit most from cognitive self-instruction training. Copeland (1981) notes that cognitive maturity should be considered when designing treatments with less mature children apparently needing more explicit, structured fully described instructions, whereas the cognitively more mature children often generate and can successfully use more abstract conceptual instructions. Copeland goes on to state that there may exist "moderating variables" which cut across several subject characteristics and would more efficiently describe the relevant individual differences. Copeland states that verbal abilities may underlie the findings due to cognitive level differences. This idea is compatible with and inherent in the theory underlying self-instructional methodology.

In Thought and Language , Vygotsky (1962) states that children use words as aids in establishing mutual understanding with adults and among themselves. Although words take on the function of communication, it is long before they reach the level of concepts, a characteristic of fully developed thought. So while a child develops the functional linguistic equivalent of concepts at an early age, the forms of thought used in dealing with these conceptual tasks differ profoundly from an adults' in composition, structures, and mode of operation.

According to Vygotsky (1978), the development of concept

formation is inextricably linked with the intellectual linguistic activities and the environment. The processes which eventually result in concept formation begin in earliest childhood, but the intellectual functions that in a specific combination form the psychological basis of the process of concept formation take shape and develop later on. Before that time, certain intellectual formations that perform functions similar to those of genuine concepts to come can be found.

Vygotsky (1962) states that complex activities incorporate the processes of association, attention, imagery, inference or determining tendencies but that they are all indispensable, but insufficient without the use of the word, as the means by which we direct our mental operations, control their course and channel them toward the solution of the problem confronting us. Learning to direct one's own mental process with the aid of words or signs is an integral part of the process of concept formation. The ability to regulate one's actions by using auxiliary means reaches its full development only in adolescence.

The ascent to concept formation is made in three basic phrases each in turn divided into several stages. This continuum is outlined briefly below. The young child takes the first step towards concept formation when he/she puts together a number of objects in unorganized categories, or "heaps" in order to solve a problem. He/she evolves from this very subjective point of view to a more objective one where he/she no longer bases connections on subjective impressions but on more concrete, factual bonds. As he/she moves

through the next stages of "complexes", the lines along which he/she develops are predetermined by the meaning a given word already has in the language of adults and is not spontaneously developed by the child. "The language of the environment points the way that the child's generalizations will take but constrained as it is, the child's thinking proceeds along this preordained path in the manner perculiar to his level of intellectual development. The adult cannot pass on to the child his mode of thinking. He merely supplies the ready-made meaning of a word" (Vygotsky, 1978, p.68).

A false assumption is made that since much of the language a child uses mimics the words of the adults, that the child's thinking is similar to all forms of adult intellectual activity. At the complex stage, word meanings as perceived by the child refer to the same objects the adult has in mind which ensures understanding between child and adult, but the child thinks the same thing in a different way, by means of different mental operations. Verbal intercourse is a powerful factor in the development of the child's concepts. It is not until the child reaches a certain level of sophistication or conceptualization of concepts and language, that he/she could be expected to generalize a highly semantic type of intervention to other than the experimental and specific situation in which he/she learned it. This appears to be the problem in the self-instruction training literature in that researchers providing the instructions assume that the words have the same meaning for all the children without considering the language developmental limitations of the child.

The last stage of concept formation requires the ability to abstract, to single out elements, and to view the abstracted elements apart from the totality of the concrete experience in which they are embedded. Only the mastery of abstraction, combined with advanced complex thinking enables the child to progress to the formation of genuine concepts. The decisive role in this process is played by the word deliberately used to direct all the past processes to advanced concept formation.

Even the adolescent may encounter an obstacle when he/she tries to apply a concept that he/she has formed in a specific situation to a new set of circumstances. The adolescent will form or use a concept quite correctly in a concrete situation but will find it difficult to express that concept in words and the verbal definition will, in most cases, be much narrower than might have been expected from the way he/she used this concept. This more advanced use of words and the more mature use of language aids the child in understanding of the language and the concepts used by adult.

Summary

The literature on problem-solving behaviors and methodology is voluminous but certain central themes remain prominent. One such theme is the value of the generalizability of problem-solving strategies (Greeno, 1979; Newell, 1979). Numerous researchers and authors have outlined heuristics for aiding the generalizability of problem-solving strategies (Borkowski & Cavenaugh, 1979; Brown, 1978; Brown, Campione, & Murphy, 1977). In recent years, cognitive self-instruction strategies have proven effective in aiding the student to focus, direct, adapt, and implement problem-solving methodology through a series of self-mediating statements (Meichenbaum, 1977; Meichenbaum & Goodman, 1971).

The basis and origins of self-instructions are derived from the developmental work of Vygotsky (1962) and Luria (1961). Vygotsky and Luria's work emphasized the interrelationship of thought and language and its effects on development. They hypothesized that aspects of speech particularly "internal speech" develop control and help regulate behavior. Meichenbaum (1971) incorporated this concept and developed a treatment whereby he provided and taught children to "self-instruct" themselves to gain control over overt behavior.

Self-instruction training has proven effective with a number of populations such as with children who are retarded (Burgio, Whitman, & Johnson, 1980; Leon & Pepe, 1983), emotionally disturbed (Swanson, 1985), hyperactive (Douglas, Parry, Morton, & Garson, 1976)

and "normal" children (Schlesser, Meyers, & Cohen, 1981), as well as with numerous target behaviors such as simple motor movements (Meichenbaum & Goodman, 1969a), delay of gratification (Hartig & Kanfer, 1973), psychometric measures (Meichenbaum & Goodman, 1971), and on-task performance (Bornstein & Quivillon, 1976).

Self-instruction training has proven most effective with children who display deficient task performances (Genshaft & Hirt, 1980; Schunk & Rice, 1983; Snyder & White, 1979) and particularly effective in modifying the response pattern of impulsive children (Meichenbaum & Goodman, 1969; Kendall & Finch, 1976; Palkes, Stewart, & Freedman, 1971; Palkes, Stewart, & Kahana, 1968). Researchers investigating the response pattern and "cognitive tempo" of impulsive children (Kagan, 1966; Weithorn & Kagan, 1977, 1979, 1984) have noted that the failure of impulsive children to use verbal mediation may be a factor in their poor impulse control and their concomitant poor performance on many academic tasks. While results proved effective in modifying impulsives responding on psychometric measures, other studies investigated their responsiveness to more academically oriented tasks (Bryant & Budd, 1982; Genshaft & Hirt, 1980; Robin, Armel, & O'Leary, 1975). Results for generalization, however, remain inconsistent and equivocal (Friedling & O'Leary, 1979; Meichenbaum & Asarnow, 1979; O'Leary & Dubey, 1979). Hobbs et.al.(1980) noted that the failure of the studies to obtain generalization may have been due to failure to program treatments for generalization as well as failure to consider subject characteristics and limitations. Copeland (1981) also emphasized the importance of considering subject variables in

cognitive self-instruction training.

Both subject and treatment variables were investigated as to their effects on the ability to generalize self-instruction training. Results indicated the need to design the instructional package for the particular subjects, that is, employing strategies with younger children requiring more explicit and concrete instructions and with older children more general broad instructions applicable to a number of problem solving situations (Kendal & Wilcox, 1980; Mischel & Patterson, 1976; Patterson & Mischel, 1976). Results for generalization, however, remained equivocal and reseachers began investigating the cognitive developmental level of the child employing the instructions as age is an inexact measure of cognitive ability (Cohen, Schleser, & Meyers, 1981; Wasserman, 1983). Results indicated that cognitively less mature children did best with specific instructions, and cognitively more mature children were able to utilize general, conceptual instructions (Nicol, Cohen, & Meyers, 1982). While there was evidence for generalization in these studies the results were not overwhelming. A very important aspect of this study was that similar effects were demonstrated on nondysfunctional children as had been found with children who displayed deficient performances. While substantial generalization effects were demonstrated when the cognitive developmental status of the child was considered, the specific dimensions of the "cognitive developmental" status that influenced generalization were vague and not clearly delineated.

Greater generalizability was indicated in those studies that

provided the opportunity for greater compatibility between the subject and the language of the instruction (Douglas, et.al., 1976; Snyder & White, 1979). Other studies that directed the students to discover a generalized self-instruction plan also resulted in improved generalization findings (Schlesser, Meyers, Cohen, & Rodrick, 1984). The greatest generalization was demonstrated when the cognitive developmental capibilities were considered and the instructions provided were compatible with the language of deficiently performing children (Schlesser, Meyers, Cohen, & Thackway, 1983; Thackwray, Meyers, Schlesser, & Cohen, 1985). Researchers investigating subject variables in cognitive self-instruction training have noted that language development and verbal ability may play an important role in maximizing the effects of self-instruction training (Copeland, 1981; Copeland & Hammill, 1981). This idea is consistent and inherent in the theory underlying self-instruction methodologies.

Luria (1981) and Vygotsky (1978) similarly noted that language develops over a period of time initially being more literal and concrete and gradually emerging and becoming more complex and conceptual. Vygotsky (1978) noted that although children use and mimic the words of adults, the child's thinking is not similar to all forms of adult intellectual activity. It is not until the child reaches a certain level of sophistication or conceptualization that he/she would be expected to generalize a highly semantic type of intervention to other than the specific situation in which he/she learned it. The level of language development may be the contributing

cognitive developmental factor that effects the ability of children to generalize self-instruction training, since the theory itself is based on the interrelationship of language, thought, and behavior.

The Study

The present study examines the relationship of language development on the generalizability of self-instruction training with children. It compares the effects of a general-content self-instruction format and a didactic general-problem solving format on academic task performance. It further investigates the differential effects of treatment along the impulsive-reflective dimension. The study attempts to demonstrate that children with higher levels of language development and proficiency are more apt to, and capable of generalizing a semantically based intervention such as self-instruction. The study further attempts to demonstrate the differential effects of training on the generalizability of self-instruction training with children along the reflective-impulsive dimension.

Sixty children aged 9-10 from fourth grade classes were selected and randomly distributed into one of three treatment groups. The three experimental groups were as follows: general-content self-instruction group, general didactic problem-solving group, and the attention control group.

All subjects were administered two aptitude tests prior to treatment which served as the continuous independent variables. They

received the TOLD-I (Test of Language Development - Intermediate) to measure language maturity and development, and the MFFT (Matching Familar Figures Test) to measure relative impulsivity-reflectivity.

The dependent variables were subjects performance on the PIAT (Peabody Individualized Achievment Test), which served as the generalized dependent measure, and the STT (Specific Training Test), which served as the specific dependent measure.

Data Analysis

Data were analyzed using multiple regression analyses with two continuous aptitude variables, one of language development (TOLD-I), and one along the continuum of impulsivity-reflectivity (MFFT). The dependent variables were the generalized dependent achievement measure (PIAT) and the specific training dependent achievement measure (STT), with their respective pre-tests serving as the covariates. The analyses examined the separate and combined contributions of the continuous aptitude variables in an attempt to determine the existence of an aptitude-by-treatment interaction, and significant group differences.

METHOD

Subjects

The subjects consisted of sixty children, thirty boys and thirty girls, between the ages of nine and ten years who were selected from fourth grade classes in a regular public elementary school. The school is located in a low to middle class integrated neighborhood in the Northeast section of the Bronx, in New York City. The children were of mixed ethnic background with about forty percent being Black, forty percent Caucasian, fifteen percent Hispanic, and five percent other than the above. All children were performing on or about grade level as ascertained through informal teacher estimates.

Independent Variables

The TOLD-I, Test of Language Development, Intermediate Level, was administered prior to treatment and served as the independent variable of language development. The TOLD was developed by Hammill and Newcomer (1978). The TOLD's three principal uses are: (1) to identify children's language proficiency compared to their peers; (2) to determine children's specific strengths and weaknesses in language skills; (3) to serve as a measurement device in research involving language behavior. The design of the test incorporates linguistic features such as phonology, syntax, morphology, and semantics, as

well as linguistic systems usually dichotomized into listening (receptive) versus speaking (expressive). The language systems of speaking and listening represent the manner in which language is used and understood. The two-dimensional model of language structure, that of linguistic systems and features, are used to generate the subtests of the TOLD.

The TOLD-I model generates five subtests that have been validated as being primarily a listening or speaking task and as measuring some aspect of syntax or semantics. The subtests are:

1) Sentence Combining (SC) - this is a twenty-five item subtest integrating elements of both listening and speaking ability, but considered primarily a speaking task, where the child must form one compound or complex sentence from two or more simple sentences said by the examiner.

2) Characteristics (C) - this fifty-item subtest is primarily a listening task requiring the child to determine the truth of simple statements that are spoken by the examiner.

3) Word Ordering (WO) - this twenty-item subtest integrates both listening and speaking ability primarily considered a speaking task where the examiner says a series of randomly ordered words and the child has to reorder them to form a complete, correct sentence.

4) Generals (G) - this twenty-five item subtest is essentially a speaking task although some listening ability is required. On this test the child must tell how three words spoken by the examiner are alike.

5) Grammatic Comprehension (GC) - this forty-item subtest primarily

involves listening abillity. It measures the child's ability to recognize incorrect grammar in spoken sentences.

Subtests are then grouped in accordance with common features or systems to generate five composite language quotients:

1) syntax combines SC+WO+GC

2) semantics combines CH+GL

3) speaking combines SC+WO+GL

4) listening combines CH+GC

5) total spoken language combines all five subtests.

The TOLD-I is used to measure the language skills of most children between the ages of 8-6 and 12-11 years. The TOLD-I is a norm-referenced test with established reliability and validity. Hammill and Newcomer (1982) present the reliability data in the form of internal consistency, stability, and standard error of measurement. Measures of internal consistency revealed coefficients greater than .80 for all measures using coefficient alpha, suggesting good internal reliability. Stability reliability revealed Pearson product-moment coefficients exceeding .80 suggesting the Told-I is a stable instrument. The standard error of measurement is reported to be quite small and stable across age levels. Hammill and Newcomer (1982) present data for content, construct, and criterion-related validity. Content validity was judged by a group of professionals in the field who rated the content of the subtests to be consistent with the constructs and the model of language presented in the test. Construct validity is reported as adequate as the test demonstrated that the scores are age related and the subtests highly interrelated.

Criterion-related validity indicates correlations of .83 when compared to another measure of spoken and written language.

The MFFT, The Matching Familiar Figures Test, was developed by Kagan (1965) and is used to determine the relative impulsivity-reflectivity dimension of an individual. The test involves the presentation of a stimulus figure, the standard, and similar variants only one of which is exactly the same as the standard. There are twelve items on the test from which two scores are collected: a latency score which is computed as the mean reaction times to the first response, and an error score which is the total number of errors across all twelve items. Cognitively impulsive children in grades 1-4 have a mean response time between four and ten seconds and make about fifteen to twenty errors. Reflective children have a mean response time between thirty to forty seconds and make between two to six errors (Kagan, 1966). The critical variables scored are response time to the child's first answer and the total number of errors across the twelve item test. Impulsive children typically respond quickly with many errors and reflectives are children who show longer latencies but fewer errors (Kagan, 1966).

Dependent Variables

The PIAT, Peabody Individualized Achievement Test (Dunn and Markwardt, 1970) was administered to provide a wide-range screening measure of achievement and served as the generalization measure. The test was administered pre and post-training with the pre-test serving

as the covariate. It is an individually administered, norm referenced test that includes five subtests: Math, Reading Recognition, Reading Comprehension, Spelling, and General Information. The test also yields a general achievement measure. The Mathematics subtest consists of 84 multiple-choice items with four options for each item which tests skills ranging from readiness to high school. The Reading Recognition subtest contains 84 items that range from pre-school to high school levels selected from vocabulary lists of basic reading series. The Reading Comprehension subtest contains 66 items consisting of a passage that the subject reads and then four illustrations from which he/she selects the best representative illustration. The Spelling subtest contains 84 multiple-choice items ranging from kindergarten to high school levels which were selected from a cross section of spellers and language textbooks. The General Information subtest contains 84 questions pertaining to science, social studies and the arts. Items are read to the subjects and are answered orally.

The PIAT is an untimed power test with items arranged in order of difficulty; this permits the examiner to administer only those items that can be completed by the subject. It uses a basal and ceiling criteria to determine the beginning and ending points. Standarization sample was 2,500 students from mainstream public schools throughout the continental United States. Reliability is reported in terms of test-retest reliability coefficients using Pearson product-moment correlations. The resultant reliability coefficients resulted in a median coefficient of.78. Content validity

is reported as adequate due to the rigorous item selection in the development of the PIAT which included an extensive review of curriculum material, and consultation with curriculum experts. Concurrent validity indicates an overall product-moment correlation coefficient of .58 with another measure of scholastic aptitude.

The STT (Specific Training Test) is a test designed to measure the specific effects of training. It is comprised of one unit, twenty items, of the 'Using the Context' workbook, the training material utilized during the training sessions. It was administered pre and post training.

PROCEDURE

All the children participated in eleven forty-minute sessions over a three month period. The duration and number of sessions was based on prior studies investigating the effects of cognitive-behavioral interventions on academic achievement, in which treatment ranged from four sessions for four weeks (Schleser, 1983), to sixteen sessions in eight weeks (Genshaft, et. al., 1980), to two sessions (Leon & Pepp, 1983), with varying degrees of success. The first session was for the administration of the TOLD, the independent variable of language aptitude, and the MFFT, the other continuous aptitude variable. The second session was for the administration of the PIAT, the dependent variable, as well as the specific training test. The sixty children were randomly distributed into one of three

treatment groups with an equal number of boys and girls represented in each group. The three groups were: 1) General Self-Instruction, (2) General Problem Solving, and (3) Attention Control group. After the two initial testing sessions the children participated in eight training sessions during which the children practiced their respective training on the training materials provided. When the eight sessions of training were completed they were readministered the PIAT and a Specific Training Test (Using the Context) to determine each child's growth in response to the treatment provided. The same form of the PIAT was used although a different unit of the "Using the Context" was used at posttest.

The PIAT and the Specific Training Test (STT) were administered by two Educational Evaluators, and the TOLD-I administered by two Speech and Language Evaluators. Both tests were administered according to the standards and instructions set forth in the manuals. The MFFT was administered by a fourth year doctoral student trained in the administration of psychometric measures. All testing and training was conducted in private offices in the school.

Training Materials

Reading and math worksheets that are part of a fourth grade curriculum served as the training material during treatment. Reading worksheets used were from the Barnell Loft Ltd., Specific Skill Series, titles "Using The Context" and "Getting the Facts". In "Using the Context" the typical format consists of reading short

passages and answering questions based on the context clues contained in the paragraph (see Appendix A). In "Getting the Facts " the format consists of reading a paragraph and then scanning the passage to answer questions based on facts contained in the selection (see Appendix B). Math worksheets were selected from the Houghton and Mifflin Series and corresponded to the current topic being reviewed in class and deemed appropriate by the classroom teacher (see Appendix C). It focused on a wide array of math problems.

The utilization of this naturalistic training material was used to enhance the meaningful nature of the treatment in helping the child recognize the relevance of the training and apply it to familiar situations and problems. Similar use of naturalistic worksheets was found in Bryant and Budd (1983); they concluded it proved to be more purposeful and useful, having more meaning for the students.

Training

There were twenty children in each of the three experimental groups: general content self-instruction group, a general problem-solving didactic group, and an attention control group. Each of the experimental groups met for a total of eight sessions of training. Each group of twenty was broken down into four groups of five in order to make training more relevant and manageable, and to enable the students to learn by watching the modeling of each of their peers. Kendall and Wilcox(1980) utilized and found effective

small group instruction for cognitive-behavior therapy so that vicarious learning is fostered by watching a peer with whom the student more readily identifies.

The self-instruction groups received training that follows the self-instruction procedures adapted from Meichenbaum & Goodman (1971). The five-step procedure is designed to promote gradual internalization of instructions through modeling, active rehearsal and involvement. First, the trainer models task performance and talks out loud while the child observes (Cognitive Modeling). Second, the child performs the task while the trainer says the instructions out loud (External Guidance). Third, the child performs the task while instructing him/herself out loud (Overt Self-Instruction). Fourth, the child performs the task whispering the self-instructions (Faded Rehearsal). Fifth, the trainer performs the task using covert self-instructions with pauses and behavioral signs of thinking (i.e., stroking beard or chin). The child then performs the task using covert self-instructions (Covert Self-Instructions). The entire procedure was presented during the initial sessions and was repeated for each member of the group. The children, therefore, not only observed the trainer, but also watched their peers.

The composition of the self-instruction package was constructed to include the four components proposed by Meichenbaum (1971). They are: task relevant statements that identify and define the problems, self-guiding statements to plan an appropriate strategy and problem approach, self-monitoring statements that serve to focus attention and evaluate progress, and self-reinforcing statements to reward

correct performance.

General-Content Self-Instruction

The general-content self-instruction package contained five SI statements that are geared to provide a broad problem-solving approach. The general content instructions were adapted from Schlesser et.al. (1981), and Ferrigno, Wasserman, and Fish (1984) who similarly investigated the effects of general-content self-instructions. The instructions were as follows:

1) problem definition (i.e. What do I have to do)
2) problem approach (i.e. What are the possibilities)
3) focus attention (i.e. Focus and concentrate)
4) response guidance (i.e. Choose an answer)
5) self-reinforcing (i.e. Good job)

The instructions did not vary and were utilized for the appropriate training task of the day.

General Didactic Problem-Solving Group

The general didactic problem-solving package contained the same general problem-solving information contained in the self-instructional package but was worded in the second person with no active nor covert rehearsal. No self-instruction training nor any self-reinforcing statements were included. The students were

instructed as to the use of the general problem-solving steps in solving the training tasks, and the applicability of the steps in solving other tasks.

Attention Control Group

The attention control group met with the experimentor the same number of times as the other treatment groups but did not receive any self-instruction training nor problem-solving strategies. They performed the same assigments as the other two groups but received only the specific instructions they are normally given by the teacher in the classroom.

A reliability check to determine if the training of the self-instruction group and the general problem-solving group were suffiently dissimilar in content but similar in format was conducted by tape recording selected sessions. Sessions 2, 4, and 6 were taped for both the self-instruction and general problem-solving groups. The tapes were judged by an independent qualified psychologist familiar with cognititve-behavioral modification and it was determined that the training was separate yet equal in the quality and quantity of their presentations.

Training Sessions

The first of eight training sessions involved the development of rapport between the trainer and the students and incorporated a discussion regarding academic tasks and improving performance. The self-instruction procedure was introduced with the trainer reviewing the self-instructional steps. The second and third sessions incorporated the use of,and practice in using the self instructions on the first reading task, 'Using the Context'. During the third session, the children worked independently and were encouraged to use the self-instructions on the reading task. The forth and fifth sessions incorporated the use and practice of the self-instructions to another reading task,'Getting the Facts'. Similarly the children were encouraged to use the SI as they independently completed their reading assignment during the fifth session. The sixth and seventh sessions focused on the application of the self-instruction treatment on the math worksheets. The eighth session ended with a discussion about how the self-instruction tasks are applicable to a number of different tasks. The corresponding sessions for the general problem-solving group began with the presentation of the general problem-solving steps and application of the steps in their approach to the same training material. The GPS steps however did not incorporate any active rehearsal nor self-reinforcing statements and were worded in the second person. A more detailed procedure of the specific training for each group is included in the Appendix D.

Students in both the self-instruction and general problem-solving

groups were asked at the end of their performances on each of the dependent measures, the PIAT and the STT, to honestly state whether or not they had used their individual training during their performances.

Post-Tests

Following training all groups received a post-test administration of the PIAT to determine improvement in achievement. The PIAT served as the generalized dependent measure as both the format and the specific skills required on the PIAT subtests differed from those used during training. The PIAT performance was evaluated for a general achievement improvement utilizing the post-grade total which is the most reliable measure on the PIAT. The post-grade total was determined by combining the scores of the five individual subtests. Two of the subtests on the PIAT were similar to the tasks used in training but different in format and the specific skills required in obtaining the correct answers. The other three subtests used in the computation of the post-grade total were not related to the training except that they were academic tasks.

Post-test administration of the 'Using the Context' workbook was given as the Specific Training Test (STT) to determine the specific training effects on the training material. This served as the specific dependent measure.

Data Analysis

Data were analyzed using a multiple regression analysis with two continuous aptitude variables and one categorical treatment variable. The regression analysis was used to examine the separate and combined contribution of the continuous and categorical variables on the criterion to examine the existence of an aptitude-by-treatment interaction between the continuous aptitudes and the treatments. The aptitudes considered were the degree of language development as measured by the TOLD-I, and the relative degree of impulsivity-reflectivity as measured by the MFFT. The mean latency time was computed for each subject and was used as the measure of impulsivity/reflectivity as this is the most reliable and consistent measure of impulsivity (Kagan, 1965). Mean latency time is computed by taking the total initial response time for all cards presented, and divide them by twelve. The categorical treatment variable contains three levels of instruction: a self-instruction group; a general problem-solving group; and an attention control group. The dependent variables are general academic achievment as measured by the PIAT, and specific academic achievement as measured by the Specific Training Test (STT) with the respective pre-tests serving as the covariates.

Hypotheses

1) The General-Content Self-Instruction Group will show a significant increase on the dependent generalized measure (PIAT) compared to the other experimental groups.

2) The General-Content Self-Instruction Group will show a significant increase on the specific dependent measure (STT) compared to the other experimental groups.

3) The General-Content Self-Instruction training group who display higher levels of language development will show the greatest increase on the generalized dependent measure (PIAT) compared to the other treatment groups.

4) The General-Content Self-Instruction group who display higher levels of language development will show the greatest increase on the specific dependent measure (STT) compared to the other groups.

5) The General-Content Self-Instruction group who score high for impulsivity will show significant post treatment gains on the generalized dependent measure as compared to the other groups.

6) The General-Content Self-Instruction group who score higher for impulsivity will show significant post treatment gains on the specific dependent measure (STT) compared to the other groups.

7) There will be an interactive effect with the children who display the higher levels of language and impulsivity demonstrating the most significant gains on the generalized dependent measure (PIAT) with self-instruction training.

8) There will be an interactive effect with the children who display high levels of language and impulsivity demonstrating the most significant gains on the specific dependent measure (STT) with self instruction training.

In hypothesis 1-2 the overall effects of the treatment groups were tested with the PIAT pretest serving as a continuous independent variable in H-1 and the STT pretest scores serving as the continuous variable in H-2. Analysis of covariance was conducted to test overall treatment effects on the dependent measures with the respective pretests serving as the covariates. Post hoc comparisons were conducted by computing the difference between the slopes (b's) to determine specific group differences (Pedhazur, 1973). Analyses examined the amount of variance explained in the dependent variables (H-1 = Post PIAT, H-2 = Post STT) by the independent categorical variable (group membership) when pretest scores are covaried out. It was predicted that the SI training would improve performance on both of the dependent measures over and above the increases expected on both the GPS and ATTC groups.

In hypothesis 3-4, language development (TOLD-I) and PIAT pretest (H-3) or STT pretest (H-4) were the continuous independent variables with PIAT posttest (H-3) or STT posttest (H-4) as the dependent variables. Group membership was the categorical independent variable dummy coded for three groups. (SI = 1, GPS = 0, ATTC = 0 on dummy variable 1; SI = 0, GPS = 1, ATTC = 0 on dummy variable 2). Stepwise regression analyses was conducted to test for homogeneity of

slopes and tested for the interaction between continuous aptitude variables (TOLD) and categorical treatment groups on the dependent variables (H-3 = PIAT post, H-4 = STT post) after respective pretests had been covaried out. It was predicted that children displaying higher levels of language in the SI group would display the greatest gains on the dependent measures as compared to the other groups.

For hypothesis 5-6 impulsivity-reflectivity (MFFT) and PIAT pretest (H-3) or STT pretest (H-4) were the continuous independent variables with PIAT posttest (H-3) or STT posttest (H-4) serving as the dependent variables. Group membership was the categorical independent variable with two dummy coded variables used to represent membership in three groups. A stepwise regression analysis was conducted to determine homogeneity of slopes and to test for an interaction between the continuous aptitude variable (MFFT) and the categorical treatment group variable on the dependent variables after the pretests were co-varied out. It was predicted that children who display higher levels of impulsivity will show the greatest gains on the dependent measures compared to the other groups.

Hypothesis 7-8 tested for the presence of an interaction between the continuous aptitude variables of language development (TOLD-I) and impulsivity (MFFT) on the dependent measures of posttest PIAT (H-7) and posttest STT (H-8) with their respective pretests co-varied out. Group membership was the categorical independent variable with two dummy coded variables used to represent memberhip in the three groups. A stepwise regression analysis was conducted to determine the presence between of an interaction between the two aptitude variables

on the dependent variables after the pretest scores had been co-varied out.

The variables in the regression equation for each hypothesis are listed below.

Hypotheses 1-2

y	dependent: PIAT (H-1), STT (H-2)
x-1	PIAT pretest (H-1), STT pretest (H-2)
x-2	dummy variable 1: SI=1 GPS=0 ATTC=0
x-3	dummy variable 2: SI=0 GPS=1 ATTC=0
x-4	Pretest X (x-2)
x-5	Pretest X (x-3)

Hypotheses 3-4

y	dependent: PIAT (H-3), STT (H-4)
x-1	PIAT pretest (H-3), STT pretest (H-4)
x-2	dummy variable 1: SI=1 GPS=0 ATTC=0
x-3	dummy variable 2: SI=0 GPS=1 ATTC=0
x-4	TOLD-I
x-5	TOLD-I X (x-2)
x-6	TOLD-I X (x-3)

Hypotheses 5-6

y	dependent: PIAT (H-5), STT (H-6)
x-1	PIAT pretest (H-5), STT pretest (H-6)
x-2	dummy variable 1: SI=1 GPS=0 ATTC=0
x-3	dummy variable 2: SI=0 GPS=1 ATTC=0
x-4	MFFT
x-5	MFFT X (x-2)
x-6	MFFT X (x-3)

Hypotheses 7-8

y	dependent: PIAT (H-7), STT (H-8)
x-1	PIAT pretest (H-7), STT pretest (H-8)
x-2	dummy variable 1: SI=1 GPS=0 ATTC=0
x-3	dummy variable 2: SI=0 GPS=1 ATTC=0
x-4	TOLD-I
x-5	MFFT
x-6	TOLD-I X (x-2)
x-7	TOLD-I X (x-3)
x-8	MFFT X (x-2)
x-9	MFFT X (x-3)
x-10	TOLD-I X MFFT X (x-2)
x-11	TOLD-I X MFFT X (x-3)

Results

Table 1 contains the pretest means and standard deviations for all three groups (see Table 1). An analysis of variance indicated significant group mean differences on the pretest of the PIAT (Pregrdtl) between groups. No pretest differences are indicated on the pretest of the Specific Training Test (Prestt), the aptitude of language development (TOLD-I), or the aptitude of impulsivity (Mfftmlt). Analyses of Covariance were conducted on the posttest measures for all eight hypotheses to statistically control for individual group differences by covarying out the effects of the pretest from the posttest, thereby eliminating any pretest differences.

In Table 2 the results of the analysis of covariance are presented for Hypothesis 1 which tested for overall group treatment effects on the generalized dependent variable, the post-grade total of the PIAT, with the pretest serving as the covariate (see Table 2). In the stepwise regression analysis for Hypothesis 1 with the PIAT as the dependent measure results indicated that the pretest of the PIAT explained a significant amount of variance demonstrating the advisibility of covarying out the pretest for this and subsequent analyses in which the PIAT was used (H3, H5, H7). The analysis indicated significant group differences and a group by pretest interaction. Group differences were significant with an F value of 12.42 and a p of .0001, while the interaction was significant with an F value of 3.30 and a p of .0441. Caution must be taken in

interpreting group differences as the interaction suggests that the differences may not exist at all points along the regression lines.

Figure 1 graphically depicts the separate regression equations and lines for Hypothesis 1 with group differences shown by different intercepts (see Figure 1).

Group differences for pairwise comparisons are presented in Table 3 with the table of adjusted means used in the computation of pairwise comparisons presented in Table 4 (see Tables 3 and 4). Post-hoc pairwise comparisons of specific group differences were analyzed by testing differences between slopes (Pedhazur, 1973). As shown in Table 3, for Hypothesis 1 there is a significant group difference between group G1, the self-instruction group (SI), and both groups, G2, the general problem-solving group (GPS) , and G3, the attention control group (ATTC).

In Table 5 the results of the analysis of covariance are presented for Hypothesis 2 which tested for overall group treatment effects on the specific training measure, the posttest of the Specific Training Test, with the pretest serving as the covariate (see Table 5). In the stepwise regression analysis for Hypothesis 2 with the Specific Training Test (STT) as the dependent measure results indicated that the pretest of the STT explained a significant amount of variance demonstrating the advisibility of covarying out the pretest for this and subsequent analyses in which the STT was used (H4, H6, H8). The analysis revealed significant group treatment differences which indicates that Hypothesis 2 was supported. There was no treatment by covariate interaction.

As shown in Table 3, for Hypotheis 2, significant group differences exist between group G1 (the self-instruction group) and group G3 (the attention control group). There is no significant difference between group G1 (the self-instruction group) and group G2 (the general problem-solving group).

In Figure 2 separate regression equations and lines are graphically presented for Hypothesis 2 (see Figure 2). The group regression slopes are parallel as there is no significant interaction, and separate intercepts were used to reflect the significant group differences.

In Table 6 the results of the analysis of covariance for the stepwise regression analysis is presented for Hypothesis 3 which tested for the interaction of the language aptitude (TOLD-I) and the treatments, on the generalized dependent variable, the post-grade total of the PIAT, with the pretest of the PIAT serving as one of the covariates (see Table 6). In the stepwise regression analysis for Hypothesis 3 group differences were significant with the PIAT as the dependent measure. There was no aptitude (TOLD-I) by treatment interaction (ATI), and Hypothesis 3 was not supported. In Table 3, Hypothesis 3, significant group differences are indicated between group G1 (the self-instruction group) and group G2 (the general problem-solving group), as well as between G1 and G3 (the attention control group).

Figure 3 graphically represents separate regression equations and lines for Hypothesis 3 (see Figure 3). The group regression slopes are parallel as there is no ATI, and separate intercepts were

used to represent significant group differences.

In Table 7 the results of the analysis of covariance for the stepwise regression analysis for Hypothesis 4 is presented which tested for the interaction of the language aptitude (TOLD-I) and the treatments, on the posttest of the specific training test with the pretest serving as one of the covariates (see Table 7). In the stepwise regression analysis for Hypothesis 4 the aptitude (TOLD-I) and group differences were significant with the STT as the dependent measure. There was no aptitude (TOLD-I) by treatment interaction (ATI) and Hypothesis 4 was not supported. As shown in Table 3, for Hypothesis 4, significant group differences are indicated between group G1 (the self-instruction group) and group G3 (the attention control group). No other group differences were significant.

Figure 4 graphically represents the separate regression equations and lines for Hypothesis 4 (see Figure 4). The group regression lines are parallel as there is no ATI and separate intercepts were used to reflect significant group differences.

In Table 8 the results of the analysis of covariance for the stepwise regression analysis is presented for Hypothesis 5 which tested for the interaction of the aptitude of impulsivity (Mfftmlt) and the treatments, on the generalized dependent measure, the post-grade total of the PIAT, with the pretest serving as one the covariates (see Table 8). In the stepwise regression analysis for Hypothesis 5 aptitude (Mfftmlt) and group differences were significant with the PIAT as the dependent measure. There was no the aptitude (Mfftmlt) by treatment interaction (ATI) and Hypothesis 5

was not supported. As shown in Table 3, for Hypothesis 5, significant group differences are indicated between group G1 (the self-instruction group), and group 2 (the general problem-solving), as well as between G1 and G3 (the attention control group).

Figure 5 graphically represents separate regression equations and lines for Hypothesis 5 (see Figure 5). The group regression slopes are parallel as there is no ATI, and separate intercepts were used to represent significant group differences.

In Table 9 the results of the analysis of covariance for the stepwise regression analysis is presented for Hypothesis 6 which tested for the interaction of the aptitude of impulsivity (Mfftmlt) and the treatments, on the posttest of the specific training test with the pretest serving as one of the covariates (see Table 9). In the stepwise regression analysis for Hypothesis 6 group differences were significant with the STT as the dependent measure. There was no significant aptitude (Mfftmlt) by treatment interaction (ATI) and Hypothesis 6 was not supported. As shown in Table 3, for Hypothesis 6, significant group differences are indicated between group G1 (the self-instruction group), and group G3 (the attention control group). No other group differences were significant.

Figure 6 graphically represents the separate regression equations and lines for Hypothesis 6 (see Figure 6). The group regression lines are parallel as there is no ATI and separate intercepts were used to reflect significant group differences.

In Table 10 the results of the analysis of covariance for the stepwise regression analysis is presented for Hypothesis 7 which

tested for the interaction of both aptitudes, language development (TOLD-I) and impulsivity (Mfftmlt), and the treatments, on the generalized dependent variable, post-grade total of the PIAT, with the pretest serving as one of the covariates (see Table 10). In the stepwise regression analysis for Hypothesis 7 the aptitudes (TOLD-I, Mfftmlt), and group differences were significant with the PIAT as the dependent measure. There were no aptitudes (TOLD-I, Mfftmlt) by treatment interaction (ATI) and Hypothesis 7 was not supported. As shown in Table 3, for Hypothesis 7, significant group differences are indicated between group G1 (the self-instruction group), and group G2 (the general problem-solving group), as well as between G1 and G3 (the attention control group).

Figure 7 graphically represents separate regression equations and planes for Hypothesis 7 (see Figure 7). The group regression slopes are parallel as there is no ATI, and separate intercepts were used to represent significant group differences.

In Table 11 the results of the analysis of covariance for the stepwise regression analysis is presented for Hypothesis 8 which tested for the interaction of both of the aptitudes, language development (TOLD-I) and impulsivity (Mfftmlt), and the treatments, on the posttest of the specific training test with the pretest serving as one of the covariates (see Table 11). In the stepwise regression analysis for Hypothesis 8 group differences were significant with the STT as the dependent measure. There were no significant aptitudes (TOLD-I, Mfftmlt) by treatment interaction (ATI) and Hypothesis 8 was not supported. As shown in Table 3, for

Hypothesis 8, significant group differences are indicated between group G1 (the self-instruction group), and group G3 (the attention control group). No other group differences were significant.

Figure 8 graphically represents the separate regression equations and planes for Hypothesis 8 (see Figure 8). The group regression planes are parallel as there is no ATI and separate intercepts were used to reflect significant group differences.

In Table 3 it is seen that a number of pairwise comparisons of groups proved significant. Each of the odd numbered hypotheses that utilized the generalized dependent achievement measure, PIAT, indicated significant group differences between G1, the self-instruction group, and G2, the problem-solving group, as well as between G1 and G3, the attention-control group. For hypotheses in which the specific dependent variable, STT, was used, significant group differences were found between G1, the self-instruction group, and G3 the attention-control group but not between G1 and G2, the general problem-solving group.

Discussion

The present study sought to examine the effects of language development on the generalization of self-instruction training on academic tasks with regular grade children along the continuum of impulsivity/reflectivity. The first two hypotheses investigated the superiority of self-instruction training as compared to a general problem-solving training and an attention control group. The remaining six hypotheses examined the existence of an aptitude by treatment interaction. The results indicated significant treatment effects in favor of self-instruction training but did not indicate any aptitude by treatment interactions, as was predicted.

Self-instruction training proved superior to the attention control group in all eight hypotheses utilizing both the generalized dependent variable (PIAT), and the specific training dependent variable (STT). Self instruction training similarly proved significantly better than the general problem-solving training in which the generalized dependent variable (PIAT) was used but not when the specific training test (STT) was used as the dependent variable. Results of prior studies utilizing self-instruction have been equivocal in achieving generalization of training. Those studies reporting generalization have noted some key factors that may have contributed to the significant effects.

The present study incorporated into its design a number of variables that were embodied in prior studies that found generalization of training. Borkowski and Cavenaugh (1979), as well

as Brown, Campione, and Murphy (1977) have noted that one of the key elements in achieving generalization from the training task to other tasks is that the generalization task should share common features and should require similar processes as those employed in training. In the present study, the training tasks used were highly related to the criterion containing common elements between training and the new tasks. This aided the subjects in gaining valuable experience in the development of a general strategy construction within the context of the material trained, to the context of the tasks to be transferred.

In the present study the training utilized reading and math tasks which contained components of the task to be transferred, the achievement test, but the two tasks were not identical in format or skill demands. The individual was required to modify the form of the trained strategy to the different forms and problems presented in the generalization measure. Generalization may be hindered if the training tasks used are only marginally related to the task to be transferred to, and if the processes employed in training are not similar or readily apparent to those processes in the generalization task.

Results of the present study indicate significant group differences in favor of the self-instruction training group over the general problem-solving group and the attention control group on the generalization measure (PIAT). These results indicate the relative superiority of the self-instruction training in providing a strategy that enables children to transfer what they learn from one situation to another. The self-instruction group (SI) performed better than the

general problem-solving group (GPS), and the attention control group (ATTC). Of interest to note, however, is that although group differences are indicated between the self-instruction and the attention control group with the Specific Training Test (STT) as the dependent measure, no significant differences between the self-instruction group and the general problem-solving group were specified. In Table 8, it shows that the self-instruction group (G1) proved significantly better than the problem-solving group (G2) when the PIAT was the dependent variable. However this was not the case when the STT was used. One possible reason for obtaining significant differences between SI and ATTC, but not between SI and GPS may be that the GPs training was a more useful strategy as compared to the ATTC group therefore narrowing the group mean difference between the SI and the GPS group.

Another possible reason for failure to achieve significant group differences between the SI group and the GPS group on the STT may be that the STT did not prove to be an effective dependent measure for specific training effects. The scoring of the STT resulted in a restricted range of scores that the subject could possibly receive which would inhibit the analysis in detecting significant differences. In viewing the individual performance of the subjects on the STT, the data indicates that while most children in all groups showed an increase from the pre-test to post-test administration, the differece was limited. While the scores ranged from 60 to 100 percent the only ten possible scores were 60 through 100 in increments of five.

Another key element that may have contributed to the significant generalization of training effects, other than the inclusion of the "common elements" factor, was the duration of the training. In the present study training took place over a three month period. Prior studies that failed to achieve generalization of training indicated that generalization is more likely to occur when training takes place over an extended period of time (O'Leary & Dubey, 1979). By extending the training over a three month period, the self-instruction statements are perceived to be more than merely mechanical verbalizations that are uttered covertly. Extending the training provides the opportunity for the self-guiding statments to become internalized so that the subject may automatically employ them in the future.

Another major aspect of the results of the present study was that it pointed out the importance of the active participation and modeling components of the self-instruction training. The results indicated relatively greater gains of the self-instruction training group (SI) which incorporated active involvement and modeling over the general-problem solving group (GPS) that did not incorporate those aspects. In the SI group the individual not only observed others demonstrating the strategy but actively and overtly engaged in the process themselves. This was one of the major differences between the SI and GPS groups. While both groups utilized similar general problem-solving steps, simple recitation and didactic presentation of the strategy incorporated by the general problem-solving group may not have been effective in demonstrating

significant gains. The self-instruction training provided the self-guiding statements that seemed to promote the monitoring, evaluating, and the analytic processes necessary for the improvement displayed on the generalized dependent measure. Thus the active involvement of the child during instruction, defined here as the overt-to covert rehearsal of the strategy statements appears to be a critical component of the intervention program.

Meichenbaum and Asarnow (1979) suggested that the active involvement of the individual should enhance the likelihood of generalization by facilitating the retention of, and the proper use of the strategy. From observations of the children employing the strategies, it seemed that the children benefited from watching each other perform. They actively participated in correcting each other, and then demonstrated when each step or statement should be used. While the SI instructions were initially recited in a playful, sing-song manner, the children appeared to attend, retain, and utilize the statements more effectively than the GPS group. Observations noted during the SI group's session, that the children's lips could be seen moving during the covert stages of the training as if they were mumbling the statements. Informal observations at other times during the day noted that the children in the SI group initiated and jokingly recited the statements such as when standing on line during recess, and during lunch time. In contrast during the sessions with the GPS group, the children seemed less enthusiastic after the first few sessions as if the novelty of the experience had worn off. At the end of post-tests, the children in the SI and GPS

groups were encouraged to honestly state whether they had used the steps employed in their training on the tasks. Fewer children in the GPS group reported they had used their strategy (50%) while most of the children in the SI group (75%) stated they had used the instructions.

Another variable which may have contributed to the significant generalization of treatment effects for the SI group over the other groups was the particular age group selected. Prior research has indicated that younger, less mature children seem to benefit from more concrete, explicit instructions and display little ability to generalize from one learning task to another. Older more mature children appear better able to utilize the general conceptual type of instructons and generalize training to other situations and other tasks. Some studies (Schleser, et.al. 1983; Schleser et.al. 1984) suggested that there is a differential response in the ability to generalize SI training and that it was contingent upon the cognitive level of the children utilizing the SI training. Schleser et. al. (1983) hypothesized that the pre-operational childen require explicit instructions and are only able to utilize specific content type instructions but that the concrete-operational children are better able to use general content instructions and apply them to other tasks.

The present study demonstrates that children between the ages of 8-10 years who have had the exposure to regular grade school and social learning experiences are able to benefit from and generalize self-instruction training to tasks other than those used in training.

The series of studies by Schleser et. al. (1983,1984), and Nicole et. al. (1982) investigated the effects of cognitive level, Piagetian defined, on the generalization of self-instruction training. The present study sought to investigate specific aspects of cognitive development and individual differences that may differentiate between those who are best able to profit from, utilize, and generalize self-instruction training.

While the major impetus of the present study was to investigate and demonstrate significant subject variables that may help differentiate better responsiveness to SI training, the results did not indicate any significant aptitude by treatment interactions (ATI). Hypotheses 3 through 8 investigated the effects of the aptitudes of language development, impulsivity, and the interaction of the aptitudes of language and impulsiviy on the treatments. Results did not indicate any significant aptitude by treatment interactions (ATI) on either of the two dependent variables.

Hypotheses 3 and 4 investigated the effects of language development on the ability to generalize self-instruction training while hypotheses 5 and 6 investigated the effects of the level of impulsivity. For Hypothesis 3, the aptitude of language development (TOLD-I) did not prove significant, but in Hypothesis 4 TOLD-I did prove significant. This result suggest that TOLD-I explained an appreciable amount of variance and that language development may be a useful subject variable in predicting the effects of generalization of self-instruction training even though no aptitude by treatment interaction (ATI) was indicated in either Hypotheses 3 or 4. In

Hypothesis 5, the aptitude of impulsivity (Mfftmlt) proved significant in explaining an appeciable amount of variance again suggesting it may be a useful subject variable in predicting the effects of generalzation of self-instruction training, although in Hypothesis 6, the aptitude of impulsivity was not significant. There was no aptitude by treatment interaction (ATI) indicated for either hypothesis 5 or 6.

Hypotheses 7 and 8 investigated the combined effects of the aptitudes of the language and the impulsivity on the treatments. In Hypothesis 7, the combination of the aptitude of language development and impulsivity resulted in explaining a significant amount of variance, while in Hypothesis 8 the combination of the aptitudes approached significance. These results again suggest that both varibles may be important when considering responsiveness to self-instruction training although no aptitudes by treatment interactions are indicated for either Hypothesis 7 or 8. The results indicate that the aptitudes of language development and impulsivity did not significantly interact with the treatments. The results for Hypothesis 1 and 2 indicated that self-instruction training alone is powerful enough to result in significant changes in achievement, as measured by the PIAT and the STT, regardless of the level of language or impulsivity within the range studied.

One of the possible reasons that the aptitudes may not have significantly interacted with the treatments is that the aptitudes studied may not have had enough range within the population sampled to serve as valuable predictors. For the measure of language

development as measured by TOLD-I the scores could range fom 30 to 150 continuously. The range within the population sample studied, however, was normally distributed between 77 to 107. So while the language quotients used were normally distributed they may have been too limited in range thus inhibiting the analyses in detecting any ATI. The same may be true for the aptitude of impulsivity within the population sampled. The range of scores along the continuum of impulsive to reflective may also have been too limiting with insufficient variance to differentiate impulsive/reflective characteristics in interacting with the treatments. Prior studies which demonstrated significant generalization effects with SI training with impulsives typically used a clinically or behaviorally defined "impulsive" population. The levels of impulsivity may have been much greater in those studies than the levels within the "normal" population used in the present study. The limited range of impulsivity may have inhibited the analysis in demonstrating any significant aptitude by treatment interactions.

Another reason for the possible failure to obtain significant aptitude by treatment interactions may have been due to the small number of subjects used. Failure of prior studies to achieve significant ATI in many areas has often been attributed to the limited number of subjects used (Cronbach and Snow, 1974). While the number of subjects used was based on prior studies that demonstrated significant treatments effects with self-instruction training, the designs used in those studies were typically factorial designs utilizing categorical variables and not continuous aptitude

variables. In looking for ATI, using continuous aptitude variables and a multiple regression analysis, a greater number of subjects might be required to detect an aptitude by treatment interaction.

While some of the results found in the present study are highly significant, the results require cautious interpretation with restrictions on the predictive value of the findings. The study utilized a "normal" population and while the SI training proved effective with this group, the findings may not be true for children outside of the sample studied such as the gifted on the high range, and the retarded on the low range. The instructions may be too inhibitive for the gifted who often demonstrate efficient problem-solving, self-guiding behaviors while for the retarded population the instructions may be too general and conceptual for them to benefit. Similarly, the same cautions may hold true for younger and older children. As prior research indicated, younger, less mature children seem to benefit from more concrete explicit instruction and, therefore, less able to utilize the general conceptual type instructions. On the other hand children older than those studied may already be functioning on a covert level of self-regulation and show little gain with general self-instruction training.

Educational Implications

That cognitive self-instruction training works even to improve

well-functioning strategies is of interest to teachers, curriculum designers, and counselors. Prior research has typically studied the effects of self-instruction training with children and adults who displayed some deficiency or deficit functioning in one or more areas. The present study points out the efficacy of self-instruction training in facilitating the performance of those students who are already performing adequately to make even greater gains. The major implication that may be drawn from the results is that teaching a general problem solving approach aids in the application of the specific skills.

Children who possess adequate skills and knowledge are often at a loss, and perform poorly, when tasks are presented in a different format than that in which they were initially taught. Teachers often comment on how poorly children perform on tests even though the material was covered and the child performed adequately in class. The reason frequently offered for such discrepant performance is that the child probably wasn't paying attention during class or during the test, or he/she must not have studied, or he/she is just a poor test taker. Possibly another reason is that he knew the material when presented in his workbook format in class but when problems requiring similar skills were presented in a novel format he didn't know what he had to do, did not select the proper strategy, or did not adequately evaluate his performance and revise his strategy when necessary. These aforementioned general problem solving steps are executive type functions that may be of utmost importance in the acquisition, transfer, and application of learning.

General content self-instruction training aids in the ability to estimate task difficulty, to self-interrogate by asking one-self questions, to monitor the use of a strategy, and to adjust to the task demands. These higher level skills that require the selection, sequence, and evaluation of cognitive strategies can be translated into sets of self-statements that are teachable, meaningful, and applicable. This focus on the process of learning and not just the product of learning may be the antidote for the drill approach too often the focus in primary education classes.

Another key aspect of the findings of the present study which has significant educational implications is the role that the active participation of the learner has in problem solving behavior. The present study pointed out that mere teaching and recitation of a general problem-solving strategy wasn't as effective as the active engagment and participation of the students. As was noted in informal observations, the self-instruction group "played" with the self-guiding statements, applying them to other non-academic tasks. This may have helped not only to engrain the memorization and internalization of the self-statements, but also aided in the generalization and in the self-guiding process. The use of more "playful" approaches in teaching the generalization of strategies, the "what to do's", can make the learning enjoyable and less tiresome. The children are more likely to become active willling participators and incorporators and not just passive receptors.

To aid in the generalization and transfer of the problem-solving steps the teacher may present the child with a variety of tasks

involving academic, interpersonal, and play situations. The teacher could present the children with the task of identifying what the problem is, how they would go about solving the task, where the flaws in the strategy might be, and how they might evaluate the success of the strategy. Discussions could then center on the process and not just the product of the assignment. This study skill and problem solving process could become the focus of education, that is actively taught, and not merely a by-product passively acquired.

Modeling, role playing, and behavioral rehearsals can provide useful ways of teaching the same general-problem solving steps incorporating both active and passive learning experiences. The modeling of the correct sequence and procedural steps may be very useful in helping children learn 'when' to and 'what' to say in approaching a new task or new situation. Learning may be enhanced when a child is able to observe not only the adult trainer or teacher but also their classmates in overtly rehearsing the general problem-solving steps. During the sessions in the present study the students seemed enthusiastic about correcting each other, and the children being corrected seemed more receptive and less embarrassed when their classmates guided them than when the adult trainer did. Another method teachers may use to teach general problem-solving self-guiding statements is to speak aloud when they solve problems, and devise plans as when resolving a disciplinary or scheduling problem. The teachers may enlist the students in those problem solving dilemmas as well.

Future research investigating subject variables that can aid in improving the generalization of self-instruction training could benefit from the results of the present study. Some of the key factors that may have contributed to the significant degree of generalization with the SI training was the extended time in training and the selection of training tasks. The study pointed out the need for extended training that may have aided the individual in incorporating the self-instruction statements. This extended time may also be necessary for the dependent measures to detect significant changes due to treatment. Future research should allow adequate time for training as well as for the generalization process particularly when looking for improvement on complex tasks. The other factor that may have contributed to the successful generalization of training was the diversity of training tasks. The training on a number of academic task related to the dependent variables may have aided the process of transferring the learning from the training to the post tests. Future studies might well incorporate these factors when designing training programs with chidren. While directions for future research can be based on the positive asects of the finding, the negative results can be of equal value.

Similar research investigating aptitude by treatment interactions with self instruction training should consider modifying aspects of the aptitude variables used. One problem with both of the aptitudes used in the present study appeared to be the limited range in variability on both language development and impulsivity. By extending the range of these aptitudes the analysis might be better

able to detect the presence of ATI when one exists. Future studies might extend the age and the grade levels studied. By extending the grade levels to include lower and higher grades, the range of language development of the children would be increased. Similarly by including different age groups, the levels of impulsivity would increase as studies indicate that younger children tend to be more impulsive and older ones more reflective.

While increasing the variability in the aptitudes may increase the possibility of detecting any existing ATI, similarly increasing the number of subjects used might also considerably increase the liklihood of discovering ATI. In many ATI studies, the failure to detect significant interactions has often been attributed to the small number used in the study. By increasing the number of subjects used and increasing the range of the aptitude used, future studies may discover if subject variables and individual aptitudes make a significant difference in one's ability to generalize self-instruction training.

UNIT 1

Some lawns do not need mowing. Such lawns are really made of make-believe grass. These grass (1)..... are laid over the ground on top of soft pads. They are joined together to (2)..... large fields, playgrounds, and hills used for sports.

1. (A) trees (B) plants (C) carpets (D) eyes
2. (A) grin (B) cover (C) happen (D) judge

Cowhands have a (3)..... word that means "very" or "completely." That word is (4)" ....." When cowhands get angry they say, "We're plumb mad." They are often plumb tired or plumb rested.

3. (A) slang (B) yellow (C) next (D) take
4. (A) hat (B) pump (C) plumb (D) gate

Look at the sleeves of people's suits. There you will see buttons that no longer "button." The buttons (5)..... from the days of long ago when they were (6)..... to hold back long, flowing cuffs.

5. (A) feet (B) remain (C) listen (D) such
6. (A) teach (B) shiny (C) tail (D) need

Can you picture dust chasing a mop? A mop that has been treated with chemicals will absorb dust quickly. The dust seems to run after it. Such a mop (7)..... something like a (8) .....

7. (A) under (B) blue (C) well (D) works
8. (A) goat (B) doors (C) magnet (D) drum

Members of the United States Coast Guard make up the police force of the sea. They ride in (9)..... rather than cars. Their job is to make certain that the (10)..... of the sea are obeyed.

9. (A) chains (B) feels (C) crabs (D) boats
10. (A) brooms (B) teeth (C) laws (D) ships

The Young Visitors is a book that pokes fun at English society during the early 1900s. When published, over 200 thousand (11)..... of the book were sold. Surprisingly, it was (12) .....by a nine-year-old girl who never wrote another book!

11. (A) needles (B) glasses (C) copies (D) places
12. (A) towed (B) written (C) plowed (D) bathed

The wedding cake has been an important part of marriage feasts for years. In olden times the groom would smash the cake over the head of the bride! This was supposed to (13)..... a happy (14).....

13. (A) wet (B) hello (C) insure (D) far
14. (A) hotel (B) banana (C) marriage (D) bird

Lobsters are caught in wooden traps called "pots." The traps are (15)..... with (16)..... Then they are lowered to the ocean bottom by ropes. Lobsters find the traps easy to get into, but difficult to get out of.

15. (A) baited (B) travel (C) school (D) meant
16. (A) train (B) meat (C) fish (D) clear

Insects can be found almost everywhere. They buzz around high mountain peaks and thrive in swampy marshes or deep caves. But few insects are found near the (17)..... since they do not like (18)..... water.

17. (A) ocean (B) hills (C) farm (D) porch
18. (A) pretty (B) soft (C) salt (D) blue

The alligator is not a fussy eater. Not long ago a bull alligator swallowed a live, five-foot rattlesnake. Although the alligator got a sore mouth from rattlesnake poison, it seemed to (19)..... its (20)..... .

19. (A) dislike (B) scatter (C) enjoy (D) catch
20. (A) meal (B) swim (C) game (D) hobby

Appendix B

Unit 1 — JUGGLING

The crowd at the circus grows quiet. The drums roll. Bright lights shine on the center ring. A young woman stands there in a silver suit. She begins to throw balls into the air and catch them without letting them hit the ground. Three balls—four balls—soon she has eight balls sailing into the air at once. The crowd stands and cheers. Everyone admires the skill of juggling.

If you have ever tried to juggle three balls, or even two, you know how hard it is. But some people like juggling so much they practice it for hours each day. Maybe they want to get a job in a circus. Maybe they do it just for the fun.

Juggling is not something new. People did it long ago. An old statue shows a man from Rome juggling balls over two thousand years ago. American Indian women could juggle balls or stones with great skill.

All over the world there are people who like to juggle. China is known for its wonderful jugglers. In the South Sea Islands many people make a game of juggling. Young girls are especially good at it. They juggle with fruits or nuts. Some of them can keep seven nuts in the air at once—and go for hours without dropping one!

People juggle many other things besides balls, fruits, and nuts. Have you ever tried juggling plates? Don't try it unless you have plates that can't break. Some people juggle sticks or clubs. Others toss hoops into the air and catch them on their arms or even their legs. Some circus people can bounce balls off their knees or head while they juggle. Others juggle while standing on the back of a running horse!

What are the world records for juggling? For juggling balls, it is ten in the air at once. For hoops it is eleven, and for sticks and plates it is eight. Do you think you could break one of those records?

Unit 1 — JUGGLING

1. The young woman must not let the balls hit the:
   (A) crowd (B) ground (C) snow

2. After she performs, the crowd stands and:
   (A) cheers (B) leaves (C) cries

3. People who like juggling practice for hours each:
   (A) minute (B) year (C) day

4. People may want a job in a:
   (A) factory (B) circus (C) diner

5. An old statue shows a man from:
   (A) Utah (B) Asia (C) Rome

6. Besides balls, American Indian women juggled:
   (A) arrows (B) moccasins (C) stones

7. A country known for jugglers is:
   (A) Canada (B) China (C) Mexico

8. If one uses plates, make sure they cannot:
   (A) float (B) fall (C) break

9. Some people catch hoops on their arms and their:
   (A) legs (B) eyebrows (C) hips

10. People perform on the back of a running:
    (A) rabbit (B) horse (C) motor

Appendix C

More Practice

Set A

Give the missing factors.

1. [redacted] × 2 = 18
2. [redacted] × 7 = 21
3. 5 × [redacted] = 0
4. [redacted] × 8 = 32
5. 3 × [redacted] = 27
6. [redacted] × 4 = 24
7. 9 × [redacted] = 9
8. 6 × [redacted] = 36
9. [redacted] × 8 = 24
10. 7 × [redacted] = 35

Set B

Give each product or quotient.

1. 9 × 2	9. 0 × 6
2. 5 × 6	10. 16 ÷ 4
3. 9 ÷ 3	11. 1 × 7
4. 2 × 8	12. 8 ÷ 8
5. 28 ÷ 4	13. 9 × 4
6. 12 ÷ 3	14. 15 ÷ 3
7. 5 × 1	15. 6 × 2
8. 24 ÷ 8	16. 0 ÷ 9

Set C

There were 54 empty bottles to put in cartons. The boys put 6 bottles in each carton. How many cartons did they use?

2. Eight girls made 40 key rings. Each girl made the same number of key rings. How many key rings did each girl make?
3. There are 7 bags of oranges, with 6 oranges in each bag. How many oranges are there in all?
4. There were 56 plates on 8 tables. Each table had the same number of plates. How many plates were on each table?
5. Nine floats were in the parade. There were 5 people on each float. How many people rode floats in the parade?
6. There are 48 kittens at the animal shelter. Six kittens are kept in a cage. How many cages are needed for the 48 kittens?

Set D

Give each product or quotient.

1. 5 × 6	11. 7 × 6
2. 9 × 6	12. 48 ÷ 6
3. 42 ÷ 6	13. 8 × 8
4. 5 × 9	14. 56 ÷ 7
5. 63 ÷ 9	15. 72 ÷ 8
6. 8 × 7	16. 9 × 7
7. 72 ÷ 9	17. 6 × 8
8. 54 ÷ 6	18. 63 ÷ 7
9. 40 ÷ 8	19. 81 ÷ 9
10. 9 × 9	20. 49 ÷ 7

Set E

For each exercise, write a number sentence and give the answer.

1. 8 cages.
   7 cats in each cage.
   How many cats in all?
2. 54 peanuts.
   9 peanuts for each squirrel. How many squirrels in all?

More Practice

3. 72 birds.
   6 birds in each cage.
   How many cages?
4. 63 hamsters.
   7 hamsters in each cage.
   How many cages?
5. 9 fish bowls.
   8 fish in each bowl.
   How many fish in all?

Set F

1. 47 doughnuts.
   How many bags of 5 doughnuts?
   How many doughnuts left?
2. 45 hot-dog buns.
   How many bags of 6 buns?
   How many buns left?
3. 65 chairs.
   How many rows of 7 chairs?
   How many chairs left?
4. 49 oranges.
   How many bags of 9 oranges?
   How many oranges left?
5. 53 cookies.
   How many bags of 8 cookies?
   How many cookies left?

Set G

Give the missing numbers.

1. 8[redacted] R[redacted]
2. 5[redacted] R[redacted]
3. 9[redacted] R[redacted]
4. 7[redacted] R[redacted]
5. 6[redacted] R[redacted]
6. 5[redacted] R[redacted]
7. 7[redacted] R[redacted]
8. 6[redacted] R[redacted]
9. 9[redacted] R[redacted]
10. 8[redacted] R[redacted]

Set H

Show four more ratios for each table.

1. You can walk 3 blocks in 5 minutes.

   Blocks 3

2. There are 8 pints in 1 gallon.

3. You can buy 4 erasers for 10¢.

   Erasers 4

4. You can buy 2 mints for 5¢.

   Cents 5

5. 7 tickets cost $2.

   Tickets 7

APPENDIX D

Script for General Self-Instructions:

Session 1:

Development of rapport: initiation of a discussion about school in general and school performance. Introduction of general problem-solving method and self-instruction training: what it is, what it does, and when it can be used. Visual and auditory review of self-instruction steps: The steps are: what do I have to do, what are the possibilities, focus and concentrate, choose an answer, good job.

I'll be meeting with different groups of your classmates and we will be learning different ways of approaching our work. This will help your teachers and myself to determine which method is most useful. You all were given reading and math tests and we will be giving them again at the end of the training sessions together to see how much you have improved. It would be a good idea not to discuss the training that we do together with your classmates but make it like our own special way of doing things.

Session 2:

Cognitive Modeling (Refer to Appendix A) (trainer verbalizes and performs task)

1. What do I have to do on this worksheet. I have to read the selection and choose the right answer. 'Some lawns do not need

mowing. Such lawns are really rugs or make-believe grass. These green (1) _____ are laid over the ground on top of soft pads.' Now, what are the possibilities ? There are four choices: (a) tree, (b) plants (c) carpets (d) eyes. Let me focus and concentrate on what I just read to figure out an answer. Let me choose an answer . I chose carpets because it fits the information I have just read. I did a good job because I arrived at the best answer. Now, let me finish the selection. 'They are joined together to (2) _____ large fields, playgrounds, and hills used for sports.' What are my possibilities for number two. I have four choices: (a) green (b) cover (c) happen (d) judge. Let me _focus and Concentrate on what I have just read and choose an answer . I chose 'cover' because it fits what I have just read. Good job ; I did all the steps and tried my best. Okay, now that I've done it, would one of you like to try the next problem while I review the steps?"

(2) External Guidance (trainer reviews steps while student performs task) What is it I have to do? That's right, you have to read the passage and fill in the word that best completes the answer. (Subject reads on). 'Cowhands have a (3) _____ word that means 'very or completely'.' "Now, what are the possibilities?" That's right, you have four choices: (a) slang (b) yellow (c) next (d) take. _Focus and concentrate on what you read, then choose an answer . _Good job . You checked the story for clues and did your best."
"Now, who would like to try the next passage?"

This process of external guidance would be repeated for all five subjects. The next step would be the overt self-instruction stage.

(3) Overt Self-Instruction (student says and performs the task)

"Now that we've all had a chance to try the problems while I recited the instructions, you'll each take a turn saying them out loud while you do a problem. Try and remember the self-instructions but in case you forget, they are written on the board. What do I have to do. What are the possibilities. Focus and concentrate. Choose an answer. Good job.Remember to say them out loud so we all can hear when you use the statement as you do the problem."

(4) Faded Self-Instruction (student whispers SI while performing the task)

"This time we are going to use the same instructions but we are going to whisper them while we do out work. You're sitting far enough apart so your neighbor should not be able to hear you when you whisper. I want you to try the next three passages while I come around and listen. If you forget the instructions, you can look at the board."

(5) Covert Self-Instruction (student silently reviews SI while doing the task)

"During the last part of the session, I want each of you to complete the remainder of the problems in the unit, but say the instructions to yourself. Remember what to say and when to say the instructions.

Don't rush; take your time. When you are finished, we will go over your work."

Session III

Cognitive Modeling and Faded Instruction (trainer demonstrates while whispering the SI)

Review of self-instruction steps:"Who remembers how we left off last session? This time, we are going to spend our time doing more independent work. First, I will go over the steps again and whisper the self-instructions while I do the first selection in the next unit. Then we will each take a turn whispering the steps while we do a passage. We will use the second half of the session to practice saying the self-instructions to ourselves while we do the rest of the problems."

Session IV

"During the session, we are going to apply our self-instructions to a new type of task. As we said in the beginning of our meetings, the same self-instructions can be applied to many different kinds of work. Just like 'Using the Context' book, I am going to demonstrate how we use the self-instructions to our "Getting the Facts" books.

(1) Cognitive Modeling (see Appendix B)

"Okay, <u>what do I have to do</u> on this task? I again have to read a selection, but this time I have to remember what I read and then answer some questions. Since it is a long story, I'll read parts of

it and then answer as many questions as I can. (After reading the first paragraph). Okay, now let me read the question. 'The young woman must not let the ball hit the (1) _____ .' What are the possibilities : (a) crowd (b) ground (c) snow. Let me focus and concentrate on what I just read. Let me choose an answer . Good job because I found the answer in the paragraph and tried my best. Let me try the next question and see 'what the Possibilities' are. 'Focus and concentrate' on what I am doing, 'choose an answer' and tell myself 'Good job' since I tried my best and found the answer in the story."

(2) External Guidance

Who would like to do the next paragraph while I review the instructions? All of you can take a turn while the other children wait and listen.

(3) Overt Self-Instructions

Now I would like each of you to take a turn saying the self-instructions out loud while you do a paragraph and answer the questions.

(4) Faded Self-Instruction

Now I would like each of you to whisper the self-instructions while you do your work.

(5) Covert Self-Instructions

Now, each of you will do a unit by yourself saying the self-instructions to yourself.

Session V

(1) Cognitive Modeling

How many of you have the self-instructions memorized? Good, but before I let you begin on your own, I want you to watch me one last time as I go through the steps whispering the self-instructions as I solve the problems.

(2) Faded Self-Instructions and Cognitive Modeling

Each of you will now take a turn whispering the self-instructions while you do a paragraph and answer the questions.

Session VI

Now that all the self-instruction steps are memorized, we are going to use them to do math problems.

(1) Cognitive Modeling (See Appendix C)

Okay, what do I have to do? In Set A I have to find a missing number. What are the possibilities? In this problem, addition or subtraction is not right so I probably have to multiply or divide. Let me focus and concentrate and try to figure what number multiplied by 2 equals 18. Let me go through the two times table and choose an answer. Good job, I tried by best.

(2) External Guidance

Now we will each take a turn doing a problem while I say the instructions; however, we will do one problem from each set.

(See Set B) Okay, what do you have to do? That's right, multiply. What are the possibilities? That's right, multiplication. Focus and concentrate and choose an answer. Good job.

(See Set C) Okay, what do you have to do? That's right, divide. What are the possibilities? Yes, divide and end up with a remainder. Focus and concentrate and choose an answer. Good job, you took your time and tried your best.

(See Set D) What do I have to do? That's right, look at the sign and do the operation. What are the possibilities? Focus and concentrate, choose an answer and say good job.

(See Set E) What do I have to do? Yes, I have to divide. What are the possibilities? I have to divide the divisor into the dividend. Let me focus and concentrate. How many times does 2 go into 4? Now let me multiply and subtract. I have to bring down the next number and figure out how many times 2 does go into that number. I again have to subtract and mark down the remainder. I choose my answer and tell myself I did a good job because I went through all the steps I learned.

Session VII

During this session I want you to try and apply the SI steps to do five problems in each set of math problems. Remember to use your SI steps in your approach to each problem. We'll check your work when

you finish.

Session VIII

During this last session we are going to apply are SI steps to other situations. How would we apply Si to:

1) Science Lectures

2) English Classes

3) Sports

4) Test Taking

(The cognitive modeling and faded rehearsal procedure would be revlewed for the different situations)

General Problem Solving Training Script

Session I

Development of rapport: initiate a discussion about school in general, and improving school performance.

Introduce general problem-solving:what is it, when can you use it? These are the steps: what is it you have to do, what are the possibilities, focus and concentrate, choose an answer, good job.

I will be meeting with different groups of your classmates and we will each be learning dirrerents ways of doing our work. This will help your teachers and myself to determine which method might be best and most useful in teaching you new things. Everybody was given math

and reading tests at the beginning of our meeting together and we will be taking those tests again at the end of our sessions to see how much you have improved. It would be a good idea not to tell your classmates what we are learning in these sessions but try to keep it our little secret.

Session II

Today we are going to consider the general problem solving steps to some of our schoolwork. I will be listing the steps on the board, and I want you to read them to yourselves as I review them for you. How might these steps help you? In your 'Using The Context' book, how would you use these steps? Yes, you ask yourself what is it you have to do and in this case what is it? Yes, you have to read the story and fill in the answers. What is the next step? Yes, you have to look at the possibilities of which there are four. Then you have to concentrate and choose an answer. Okay, why don't we try the first unit remembering the steps to general problem solving.

Session III

Okay, who remembers the steps for doing general problem solving? Let's review them together. Who would like to do one of the problems for the class? That's right, we have to figure out what the problem is askingus to do. Now that we know what the problem is asking we have to look at the possible choices. Concentrate on your work and chose an answer. Let's do another one out loud and then you can try some on your own. Today I want you to remember those steps as you do

your assignment. Do two units and then we will go over the work.

Session IV

This time we are going to use the general problem solving steps to do a somewhat different kind of reading assignment. Who can tell me how to apply the steps to our 'Getting The Facts' books? Okay, what is it you have to do. Yes, you have to read a paragraph again, only this time you have to read a bit more of the passage and answer a couple of questions. Okay, what are the possibilities? That's right, there are three choices and you have to focus and concentrate on what you read and answer the questions pertaining to the paragraph. Keeping the general steps involved, I'd like you to do the next two units by yourself and we will go over them together.

Session V

(Same as III only using 'Getting the Facts')

Session VI

In this session we are going to apply the general problem solving steps to solving math problems. How would you go about approaching these problems using the steps we have learned? Who wants to try Set A? What do you have to do? That's right, find out the number that makes the number statement correct. What are the possibilities? Yes, either go through your 2 times table until you arrive at what number

times 2 equals 18 or simply divide 2 into 18. Remember to focus and concentrate on what you are doing and choose an answer. Let's try another one from Set B. What is it you have to do? That's right, figure out what operation you have to perform. What are the possibilities? That's right, each problem calls for a different times table. You have to focus and concentrate on your work and choose an answer.

Someone else try Set C. I have to divide and I will have a remainder. Good. Let me focus and concentrate, and choose and answer. Now someone else try Set D. That's right, you have to figure out whether it is division or multiplication. Focus and concentrate on your work and choose an answer. On the last set, Set E, the process is the same, isn't it? That's right, you have to figure out what you have to do, focus and concentrate, and choose and answer.

Session VII

During this session we are going to use the general problem-solving steps to do five problems from each set of math problems. At the end we will check our answers.

Session VIII

During this session we are going to try and apply the GPS steps to some other situations. How might we use the steps during:

1) Science Lectures

2) English Classes

3) Sports

4) Test Taking

Attention Control Group

Session 1

We are going to be meeting for eight sessions. During the sessions we are going to be doing work in the workbooks that your teacher has assigned to you. We will be going over the work at the end of each session. You may ask any questions you may have about your work. We are going to start today by working in your 'Using the Context'.

Sessions II-III 'Using the Context'

Sessions IV-V 'Getting the Facts'

Sessions VI-VIII ' math worksheets'

Debriefing Session (to take place after post-test administration)

-Discussion with students regarding their ideas on the usefulness of treatment

-Inquiry as to whether the children knew what the other treatments were and if they had used or tried the other treatment method.

-Inquiry as to how many had honestly applied the method they had learned during training on the post-test they had taken.

-Inform the children that they were free to discuss the different methods with their classmates.

Table 1

Means and Standard Deviations for Pretests, Aptitudes and Group Differences

	Group I (SI) N=20		Group II (GPS) N=20		Group III (ATTC) N=20		
Variable	M	S.D.	M	S.D.	M	S.D.	F value
PREGRDTL	37.35	8.95	36.75	8.57	31.40	4.11	3.79*
PRESTT	79.50	8.87	79.00	9.12	78.50	10.89	.43
TOLD-I	88.60	6.85	89.75	9.65	89.95	4.65	.18
MFFTMLT	13.64	8.34	8.54	4.21	9.40	5.83	2.85

* = $p < .05$, ** = $p < .01$

Note. Pregrdtl = Pretest of the PIAT, Prestt = pretest of the Specific Training Test, Told-I = Test of Language Development, Mfftmlt = Matching Familiar Figures Test

SI = self-instruction, GPS = general problem-solving, ATTC = attention control

Table 2

Analysis of Covariance Table of Stepwise Regressions for Hypotheses 1

Hypothesis 1

Variables	Total Sum of Sq.	Sum of Sq. change	df	R square change	F change	sign. F change
Pretest	4297.37	4297.37	1	.855	342.58	.0001**
Group	4520.96	223.59	2	.044	12.42	.0001**
Grp X Pre	4575.98	55.02	2	.010	3.30	.0441*
Residual	448.94		54			

* $p < .05$, ** $p < .01$

Note. DV = PIAT

Table 3

Tests of Significant Differences of Pairwise Comparisons of Adjusted Group Means on PIAT and STT for all Hypotheses

Hypotheses		Dep. Var.	Groups G1-G2 SI-GPS	G1-G3 SI-ATTC	G2-G3 GPS-ATTC
H1	Group Difference	PIAT	4.72	2.85	-1.85
	F Value		24.73**	8.14**	3.57
H2	Group Difference	STT	1.19	4.38	3.19
	F Value		.59	8.26**	3.88
H3	Group Difference	PIAT	4.75	2.88	-1.87
	F Value		24.47**	7.77**	3.44
H4	Group Difference	STT	1.49	4.74	3.25
	F Value		1.04	10.51**	3.98
H5	Group Difference	PIAT	3.80	2.24	-1.56
	F Value		13.15**	4.83*	2.50
H6	Group Difference	STT	1.48	4.54	3.06
	F Value		0.70	7.70**	3.68
H7	Group Difference	PIAT	3.80	2.24	-1.56
	F Value		12.51**	4.38*	2.43
H8	Group Difference	STT	2.21	5.19	2.98
	F Value		1.76	11.31**	3.99

H1,H2: * $p < F(.05,1,56) = 4.02$, ** $p < F(.01,1,56) = 7.11$

H3 thru H6: * $p < F(.05,1,55) = 4.02$, ** $p < F(.01,1,55) = 7.12$

H7,H8: * $p < F(.05,1,54) = 4.02$, ** $p < F(.01,1,54) = 7.13$

G1 = Self-Instruction (SI), G2 = General Problem-solving (GPS), G3 = Attention Control (ATTC)

Table 4

Adjusted Means for Tests of Pairwise Comparisons

		Groups		
Hypotheses	Dep. Var.	1 (SI)	2 (GPS)	3 (ATTC)
H1	PIAT	41.99	37.27	39.14
H2	STT	86.69	85.50	82.31
H3	PIAT	42.01	37.36	39.13
H4	STT	86.91	85.42	82.17
H5	PIAT	41.48	37.68	39.24
H6	STT	86.84	85.36	82.30
H7	PIAT	41.48	37.68	39.24
H8	STT	87.30	85.09	82.11

Note. Group 1 = Self-Instruction (SI), Group 2 = General Problem-Solving (GPS), Group 3 = Attention Control (ATTC)

Table 5

Analysis of Covariance Table of Stepwise Regressions for Hypothesis 2

Hypothesis 2

Variables	Total Sum of Sq.	Sum of Sq. change	df	R square change	F change	sign. F change
Pretest	2152.07	2152.07	1	.581	80.72	.0001**
Group	2356.31	204.24	2	.055	4.26	.0189*
Grp X Pre	2358.55	2.24	2	.001	.04	.9560
Residual	1339.78		54			

* $p < .05$, ** $p < .01$

Note. DV = STT

Table 6

Analysis of Covariance Table of Stepwise Regressions for Hypotheses 3

Hypothsis 3						
Variable	Total Sum of Sq.	Sum of Sq. change	df	R square change	F change	sign. F change
Pretest	4297.37	4297.37	1	.855	342.58	.0001**
Aptitude	4297.66	.29	1	.000	.02	.8800
Groups	4521.98	224.32	2	.044	12.26	.0001**
Grp X Apt	4552.60	30.62	2	.006	1.71	.1892
Residual	472.32		53			

* $p < .05$, ** $p < .01$

Note. DV = PIAT; Aptitude = TOLD-I

Table 7

Analysis of Covariance Table of Stepwise Regressions for Hypothesis 4

Hypothesis 4

Variable	Total Sum of Sq.	Sum of Sq. change	df	R square change	F change	sign. F change
Pretest	2152.07	2152.07	1	.581	80.72	.0001**
Aptitude	2299.83	147.76	1	.039	6.02	.0172*
Group	2533.40	233.57	2	.063	5.51	.0066**
Grp X Apt	2536.78	3.38	2	.001	.07	.9259
Residual	1161.55		53			

* $p < .05$, ** $p < .01$

Note. DV = STT; Aptitude = TOLD-I

Table 8

Analysis of Covariance Table of Stepwise Regressions for Hypothesis 5

Hypothesis 5

Variables	Total Sum of Sq.	Sum of Sq. change	df	R square change	F change	sign. F change
Pretest	4297.37	4297.37	1	.855	342.58	.0001**
Aptitude	4441.45	144.08	1	.028	14.07	.0004**
Group	4553.00	111.55	2	.022	6.50	.0029**
Grp X Apt	4578.86	32.86	2	.005	1.53	.2246
Residual	446.06		53			

* $p < .05$, ** $p < .01$

Note. DV = PIAT; Aptitude = MFFTMLT

Table 9

Analysis of Covariance Table of Stepwise Regressions for Hypothesis 6

Hypothesis 6

Variables	Total Sum of Sq.	Sum of Sq. change	df	R square change	F change	sign. F change
Pretest	2152.07	2152.07	1	.581	80.72	.0001**
Aptitude	2152.85	.78	1	.000	.03	.8661
Group	2359.39	206.54	2	.055	4.24	.0193*
Grp X Apt	2391.60	32.21	2	.008	.65	.5246
Residual	1306.73		53			

* $p < .05$, ** $p < .01$

Note. DV = STT; Aptitude = MFFTMLT

Table 10

Analyses of Covariance Table of Stepwise Regressions for Hypotheses 7

Hypothesis 7						
Variable	Total Sum of Sq.	Sum of Sq. Change	df	R square change	F change	sign. F change
Pretest	4297.37	4297.37	1	.855	342.58	.0001**
Aptitudes	4446.41	149.04	2	.030	7.21	.0016**
Groups	4553.06	106.65	2	.021	6.10	.0041**
Grp X Apt	4610.31	57.25	4	.011	1.73	.1589
Residual	414.62		50			

* $p < .05$, ** $p < .01$

Note. DV = PIAT; Aptitudes = TOLD-I, MFFTMLT

Table 11

Analysis of Covariance Table of Stepwise Regressions for Hypothesis 8

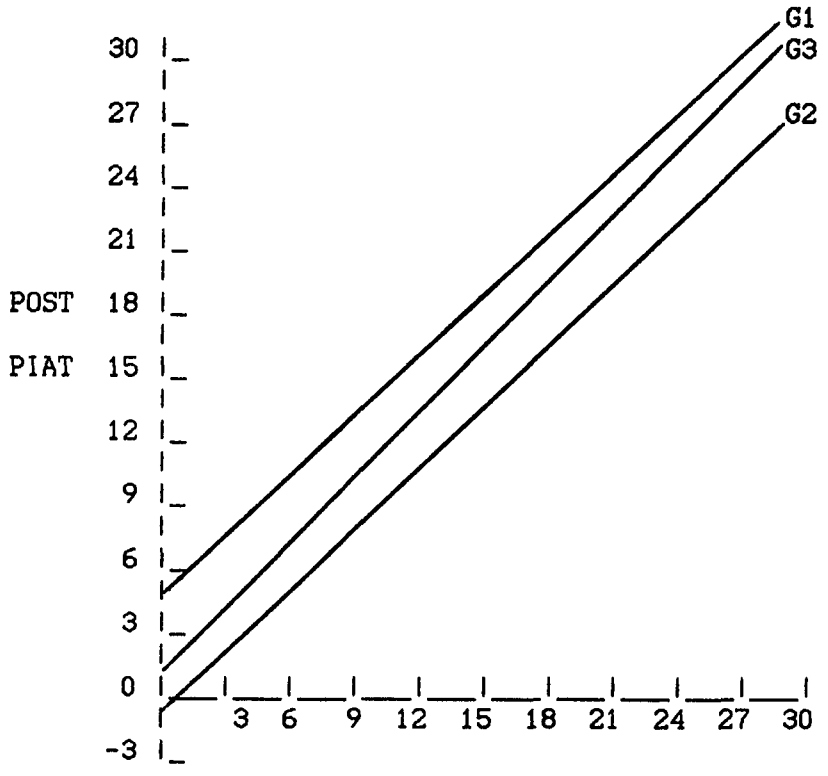
Hypothesis 8						
Variable	Total Sum of Sq.	Sum of Sq. change	df	R square change	F change	sign. F change
Pretest	2152.07	2152.07	1	.581	80.72	.0001**
Aptitudes	2300.00	148.15	2	.040	2.96	.0596
Groups	2551.28	251.06	2	.067	5.90	.0048**
Grp X Apt	2596.24	44.96	4	.012	.50	.7296
Residual	1102.08		50			

* $p < .05$, ** $p < .01$

Note. Dv = STT; Aptitudes = TOLD-I, MFFTMLT

Figure 1

Hypothesis 1: Group Differences on Post-Grade Total of PIAT



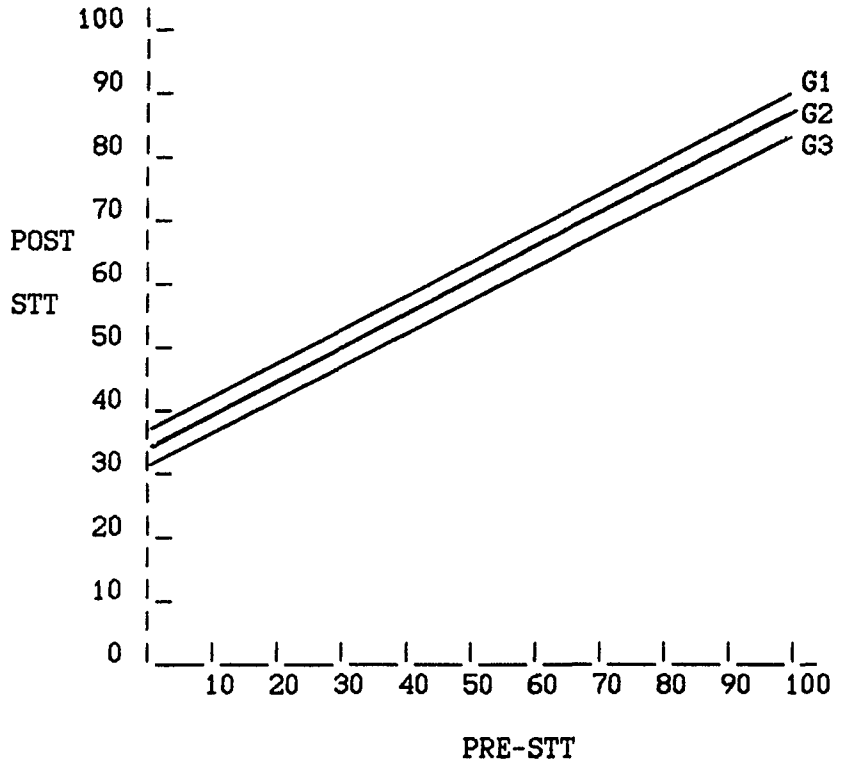
Group 1: Post-PIAT = 4.50 + 1.19 Pre-PIAT

Group 2: Post-PIAT = -.21 + .92 Pre-PIAT

Group 3: Post-PIAT = 1.68 + 1.10 Pre-PIAT

Figure 2

Hypothesis 2: Group Differences on Post Specific Training Test



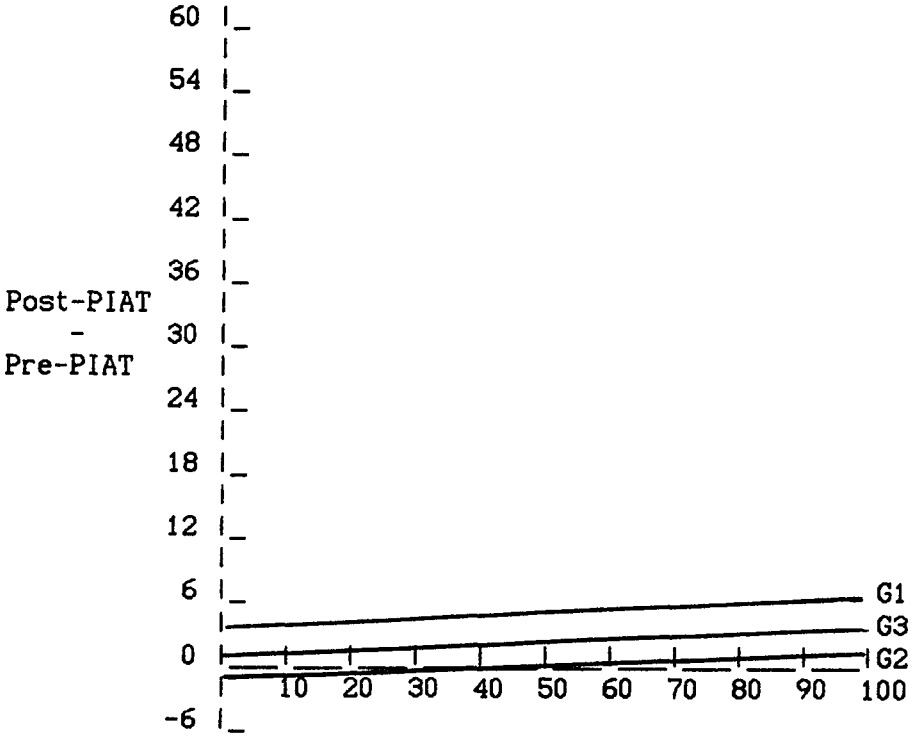
For Group 1: Post-STT = 37.18 + .63 Pre-STT

For Group 2: Post-STT = 36.00 + .63 Pre-STT

For Group 3: Post-STT = 32.81 + .63 Pre-STT

Figure 3

Hypothesis 3: Regression Equations and Lines for the Language Aptitude (TOLD-I) by Treatments on Post-Grade Total of PIAT



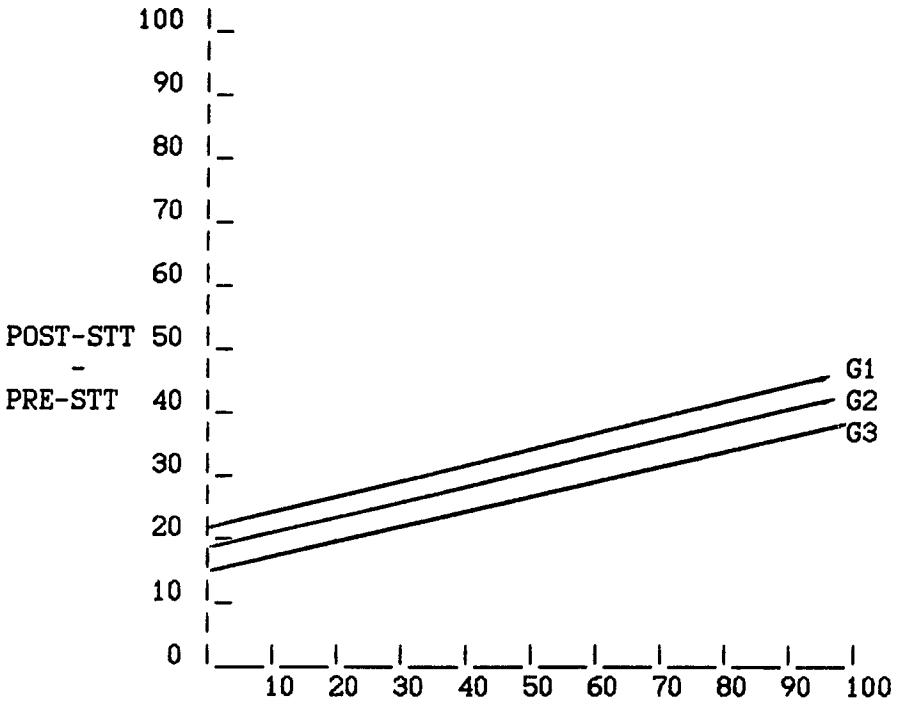
For Group 1: Post-PIAT = 3.13 + 1.06 Pre-PIAT +.02 TOLD-I

For Group 2: Post-PIAT = -1.61 + 1.06 Pre-PIAT +.02 TOLD-I

For Group 3: Post-PIAT = 1.25 + 1.06 Pre-PIAT +.02 TOLD-I

Figure 4

Hypothesis 4: Regression Equations and Lines for the Language Aptitude (TOLD-I) by Treatments the Post-Test of the STT



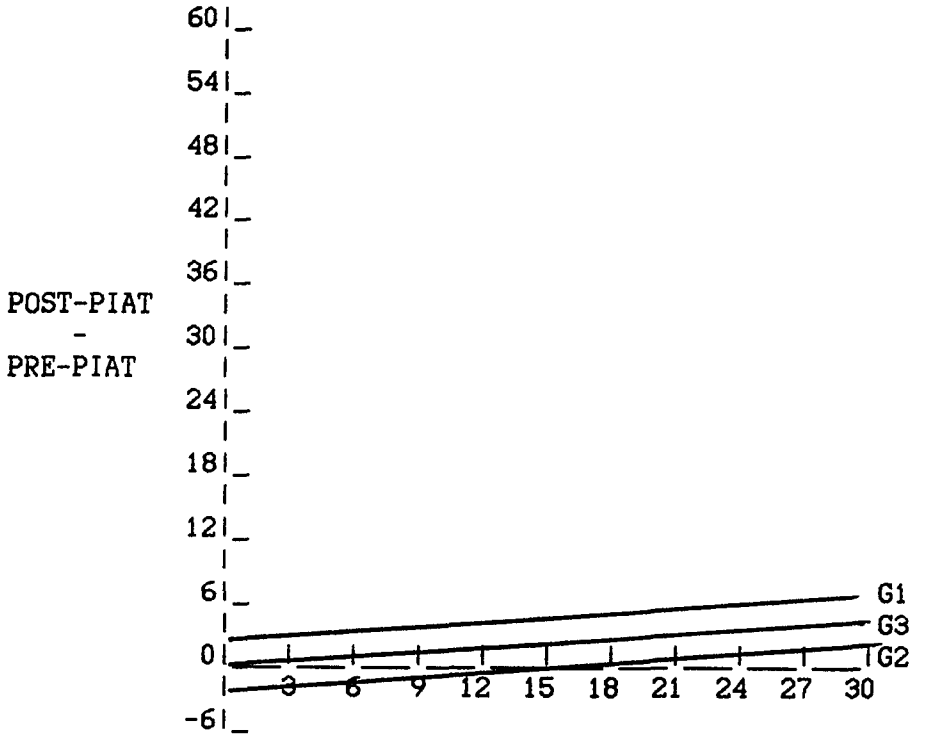
For Group 1: Post-STT = 20.44 + .58 Pre-STT + .24 TOLD-I

For Group 2: Post-STT = 18.95 + .58 Pre-STT + .24 TOLD-I

For Group 3: Post-STT = 15.69 + .58 Pre-STT + .24 TOLD-I

Figure 5

Hypothesis 5: Regression Equations and Lines for Impulsivity (Mfftmlt) by Treatments on the Post-Grade Total of the PIAT



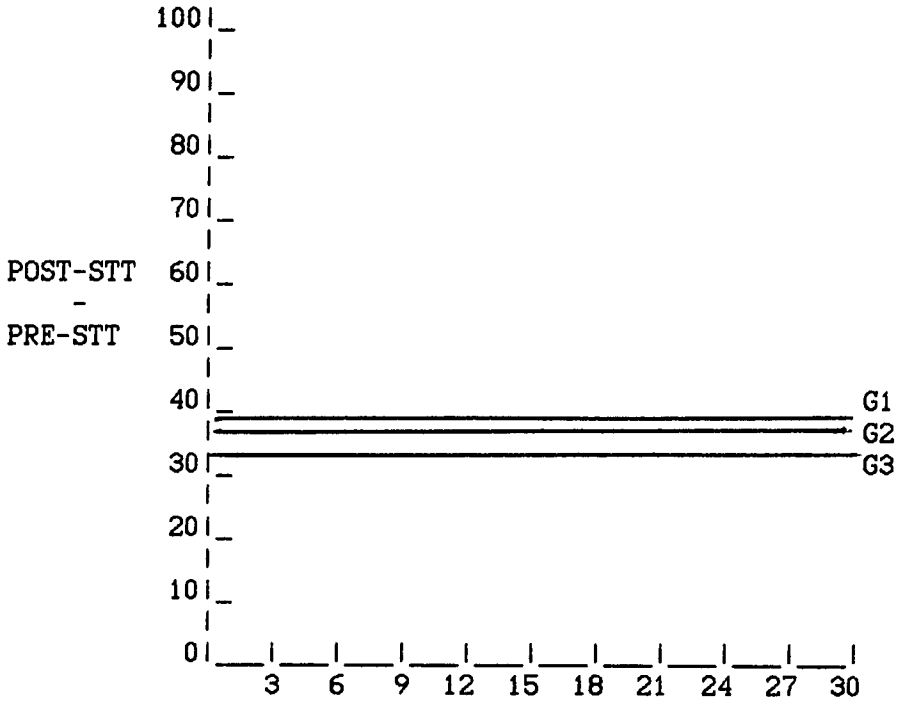
For Group 1: Post-PIAT = 2.65 + 1.07 Pre-PIAT + .13 mfftmlt

For Group 2: Post-PIAT = -1.11 + 1.07 Pre-PIAT + .13 mfftmlt

For Group 3: Post-PIAT = .41 + 1.07 Pre-PIAT + .13 mfftmlt

Figure 6

Hypothesis 6: Regression Equations and Lines for Impulsivity (Mfftmlt) by Treatments on the Post-Test of the STT



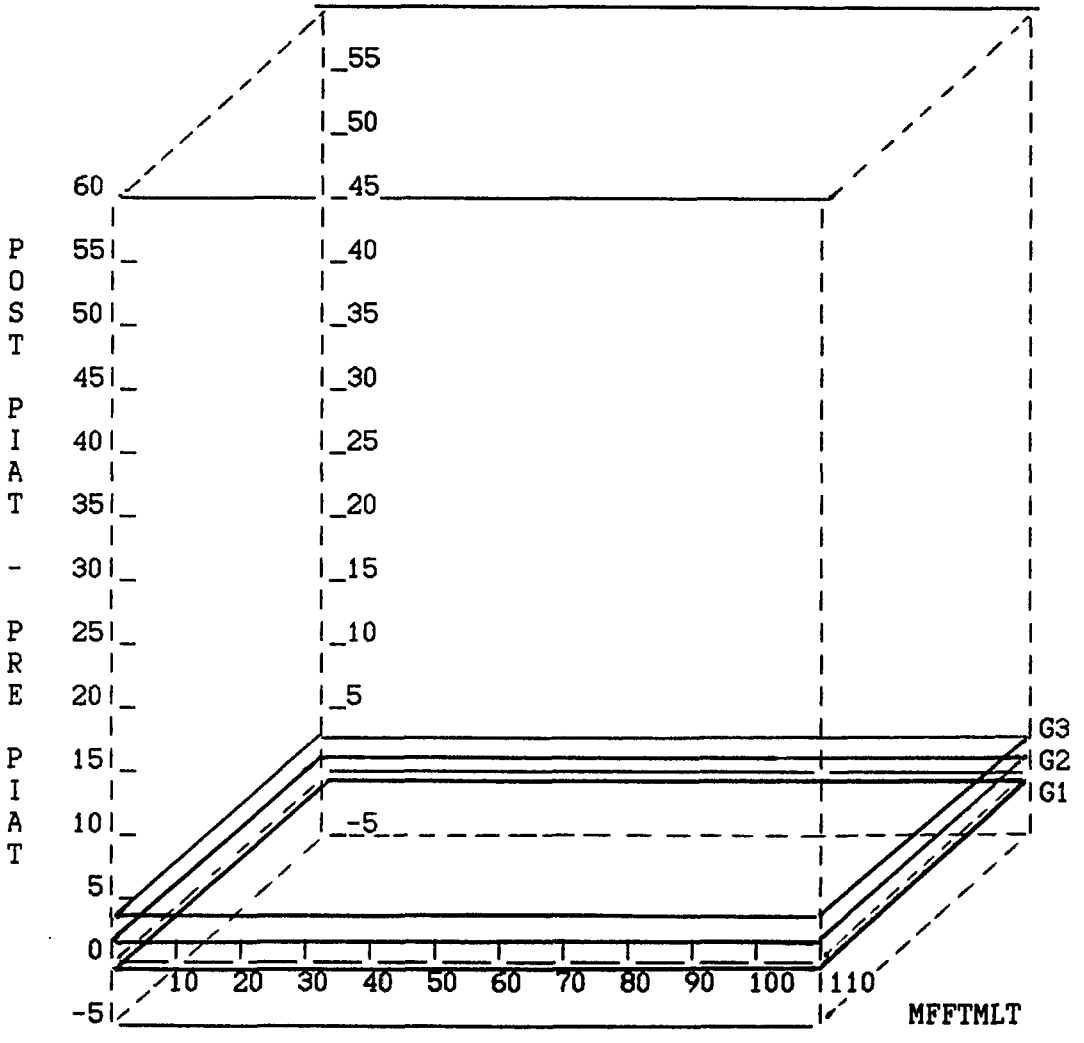
For Group 1: Post-STT = 37.62 + .63 Pre-STT - .04 mfftmlt

For Group 2: Post-STT = 36.14 + .63 Pre-STT - .04 mfftmlt

For Group 3: Post-STT = 33.07 + .63 Pre-STT - .04 mfftmlt

Figure 7

Hypothesis 7: Regression Equations and Planes for the Aptitudes (TOLD-I, MFFTMLT) by Treatments on the Post-Grade Total of the PIAT



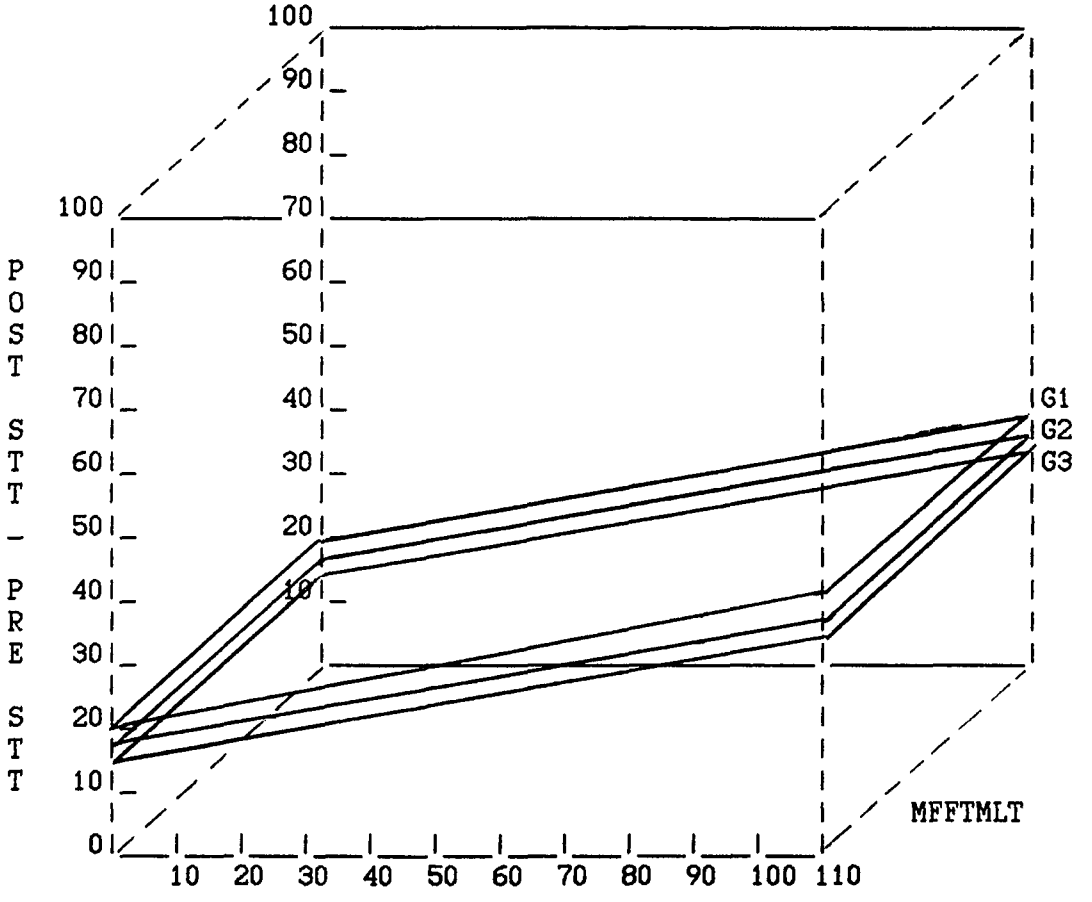
Group 1: Post-PIAT = 2.95 + 1.07 Pre-PIAT +.13 mfftmlt -.00 TOLD-I

Group 2: Post-PIAT = -.80 + 1.07 Pre-PIAT +.13 mfftmlt -.00 TOLD-I

Group 3: Post-PIAT = .73 + 1.07 Pre-PIAT +.13 mfftmlt -.00 TOLD-I

Figure 8

Hypothesis 8: Regression Equations and Planes for the Aptitudes (TOLD-I, Mfftmlt) by Treatments on the Post-Test of the STT



Group 1: Post-STT = 20.54 +.58 Pre-STT -.10 mfftmlt +.25 TOLD-I

Group 2: Post-STT = 18.32 +.58 Pre-STT -.10 mfftmlt +.25 TOLD-I

Group 3: Post-STT = 15.35 +.58 Pre-STT -.10 mfftmlt +.25 TOLD-I

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