MINIMALLY BRAIN INJURED ADOLESCENTS FUNCTIONING IN AN OPERANT CONDITIONING SITUATION

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CHAPTER I

BACKGROUND OF THE PROBLEM

Introduction

A phenomenal number of studies and experiments that attest the success of B. F. Skinner's program of operant conditioning have been complied. Skinner advocates the use of stimulus, response, and reward in motivating students to learn (Shames & Sherrick, 1963). Rewards fall under the extrinsic reinforcement category. The type of learning is seen as behavior modification. The method begins by the use of a reward or reinforcement to elicit appropriate or desired behavior. Once the procedure has been strongly ingrained and accepted by the student the instructor will progress to the normal reinforcement. Tyler and Brown's (1968) study is primarily interested in this type of achievement. They state that normal reinforcement is termed intrinsic. Some forms of intrinsic reinforcement or rewards are: 1) complimentary phrases when a lesson has been completed to the student's best ability; 2) social approval recognition by fellow classmates; and 3) realistic perception of the joy of learning.

Before behavior modification process can function properly it is advisable to identify the particular behavior to be modified. The emphasis points to overt external accountable

behavior. The elimination of specific excesses and/or the acquisition of new behaviors remains paramount.

Clement describes the behaviors most readily seen in minimally brain injured subjects. He says:

> Hyperactivity, hyperaggressiveness, phobias, excessive anxiety, and tantrums are examples of behavioral excesses. Behavioral deficits include such things as social withdrawal, underachievement, short attention span, mutism, and dyslexia (Clement, 1968, p. 270).

Some disagreement concerning how to eliminate such behaviors has arisen. Some advocate negative reinforcement; others allow inappropriate behavior to go unnoticed. Those who follow the later presume the behavior will leave if it receives no attention. Shaping follows; it begins by the reinforcement of approximations to the desired behavior. If conditioning is successful, the subject will perform without receiving rewards--extinction (Clement, 1968). Finally the subject will transfer the elimination process to other needed areas in his behavioral spectrum (pollack, 1968).

Research has shown that operant conditioning programs have been successful with a wide range of subjects. The range extends from programs with young autistic children to adult psychotic patients (Clement, 1968; Morrison, Mejia, & Miller, 1968; and Wolf, Risley, and Mees, 1963).

Problem

The problem of this study is to determine if academic achievement improves when an operant conditioning tean teaching program is initiated with minimally brain injured adolescents.

Within the special education department of the Dallas Independent School District there is a great need for a program that can help the minimally brain injured adolescents. Their age advocates an educational setting which prepared them for adjustment to society beyond the doors of special education.

Purpose.

This study adds to the known literature by showing what effect team teaching and rewards had on those involved in a public school special education program, such as the one described. Many of the studies sighted pertained to institutional, individual, or group settings. Others involved those severely afflicted by autism, mutism. A few researchers observed public school special education settings. The study reinforces previous literature concerning minimally brain injured adolescents to whom operant conditioning has been applied. Also, the results contribute to existing research and benefit a larger segment of the population.

Procedures

The study examines the potential of operant conditioning and team teaching techniques in a class for minimally brain injured adolescents, while comparing achievement scores of adolescents in a traditional minimally brain injured class. Last year a simplified operant conditioning program was used at Benjamin Franklin Junior High School. A comparison of the achievement scores shows that a majority of the students progressed; however, the scores were not statistically analyzed.

In order to test the program at Benjamin Franklin, an experiment was conducted. It entailed comparing the test results of students from two other junior high schools in the Dallas Independent School District, W. T. Browne and John B. Hood, to the scores of Benjamin Franklin students. Browne and Hood had traditional programs developed on the one teacher, no reward concept.

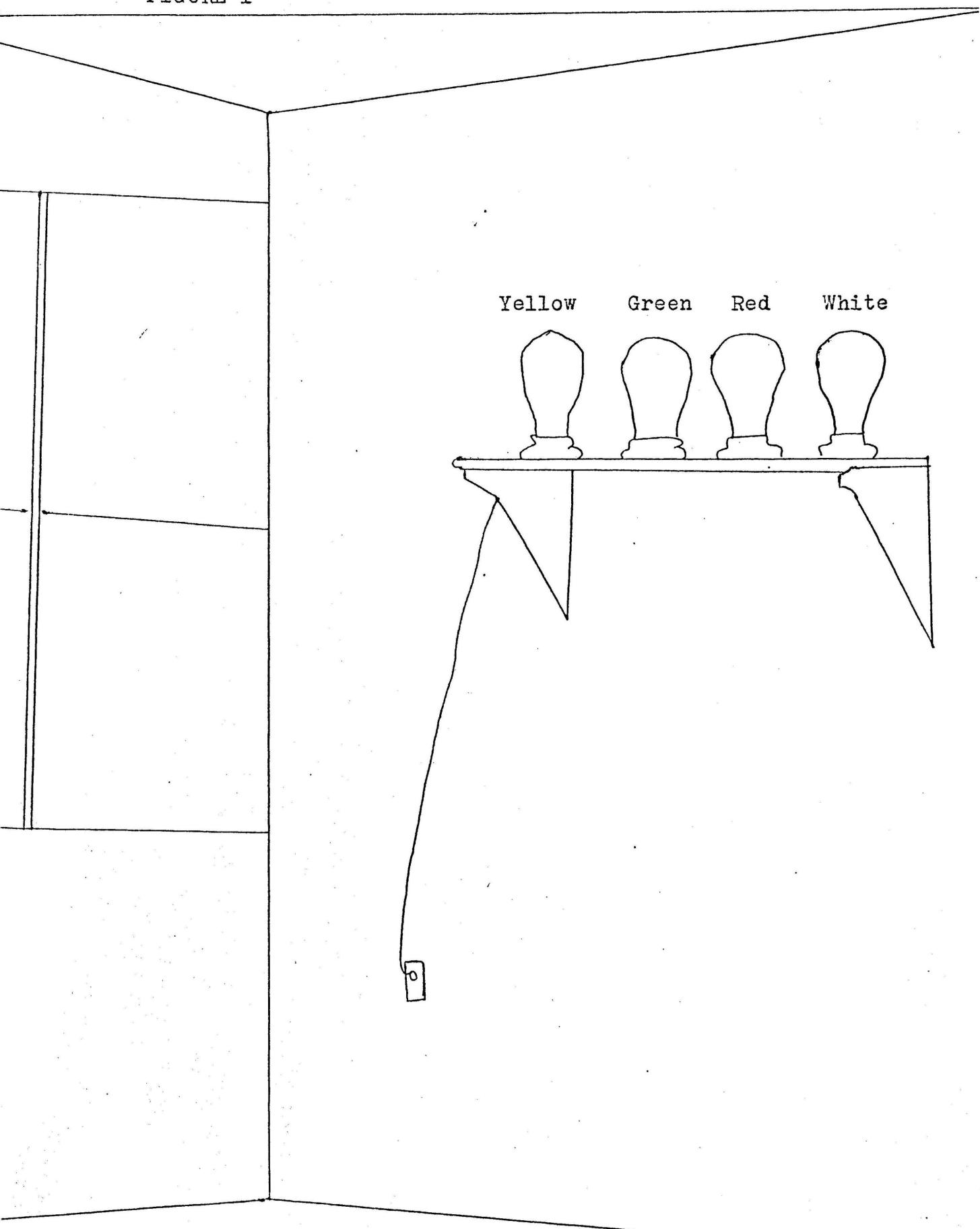
The emphasis in the experimental operant conditioning program focused on reward for appropriate academic performance. For good academic performance the students received reinforcement through points. They were earned by participating in group activities or by individual contract work.

Contract work meant assignments given out of their workbooks, readers, or special projects conducted. The students signed a written statement listing the work to be completed by a specified date. If the student did not agree with the contract, he did not have to sign but proposed a compromise.

Lights were used as part of the reinforcement program. Regular colored light bulbs were installed on a wood plank. Their operation was soundless since they turned on like a regular light switch on a wall. One of the team members or a student manipulated the system. They were located in front of the students engaged in an activity. Four colors distinguished the lights and their purposes. White elicited participation by the raising of hands. While waiting for the white light to flash the student had five fingers down on his desk. If more than one individual raised his hand simultaneously,

or so it appeared, all scored on the question; otherwise, the fastest student scored. If the student answered the question correctly, the green light flashed. The red light flashed when a mistake was made. The yellow light served as submarine quiet.

FIGURE I



During the normal day there were times when total silence was needed. At such times the yellow light controlled sound and movement of a student. If one talked or got out of his desk during the yellow light time, a penalty was imposed. The student remained after school for a detention of 10 minutes for each deviant behavior.

The point system allowed one student to win an academic certificate for achieving the largest number of points, in respect to his expectation for that week. The expectation was calculated from taking half the points earned the week before and using them as the number of points to be obtained for the new week. Some other fringe benefits for the winner included: 1) a gerbil to take home; 2) a vacation from making the expectation the following week; and 3) a chairmanship job which required helping the teacher at pertinent times.

Points accumulated during the year were converted into money: one point equaled one penny. Money was figuratively deposited in a bank account. The student aide from within the class kept a record. On auction days the student was given a booklet stating the amount in his bank account. Periodically, the auctions enabled the student to spend his money on articles such as: placemats, rabbits, ties, serving trays, decorative figurines, framed pictures, dishes, mugs, back scratchers, et cetera. Appropriate times were chosen to stage auctions, for example, Halloween, Christmas, Valentine's, Easter, and at the end of the academic year. The articles auctioned were

obtained from parent donations from home, a parent who owned a store, and contributions from other interested individuals. The auctioneer was one of the three team teachers or the student aide.

The program as outlined used negative reinforcement. A student remained after school for detention. This meant that a student missed the bus or a parent had to come later. The philosophy behind this procedure was to involve the parent in what was happening. Hopefully, the knowledge of the child's behavior would help in its elimination. Negative reinforcement was used in these instances: 1) if an expectation was not made by Friday; 2) if an assigned contract was not completed by the due date; 3) if a student talked during yellow light time; and 4) if a wrong answer was made during a group activity.

The progress of a student was evaluated by the use of pre- and post tests with team teaching vs traditional groups. The team teaching-reward situation served as the experimental group; two other junior high schools with traditional programs served as the control group. The Benjamin Franklin Junior High School team teaching-reward group consisted of 16 males and 6 females. W. T. Browne Junior High School contributed eight males while John B. Hood Junior High School provided the remainder for the control group with seven males and one female.

The California Achievement Test was administered to all students to determine academic achievement. Each year

the Special Education Department within Dallas Independent School District administers achievement tests to all its students.

The two-factor mixed design: repeated measures on one factor was used in the computing of an analysis of variance. This is basically a combination of the completely randomized design and the treatment-by-subjects design. It permits: 1) comparison of differences in the overall performances of the group; and 2) evaluation of changes in performance shown by the subjects during the experimental session (Bruning, 1968).

Limitations of the Study

When studying the results, one must realize that the three different schools may have caused the results to take a specific turn. Also within the control group, itself, two different schools participated. Ideally, it would have been better if all participants attended the same school for as small a sample as used here. The subjects under observation happened to represent all socioeconomic levels since in Dallas there were only three junior high school programs for minimally brain injured adolescents for the 1970-71 academic year and students were bused to the nearest school that provided such a program.

Testing situations undoubtedly varied. Such a condition may have caused discrepancies in the students' scoring. However, there appeared to be no way to eliminate this, unless one person had administered the test to all subjects at a set day and time.

The study was not concerned with sex differences. Male and female performance was not valid for a comparison because of the composition of the two groups. The experimental group included: 16 males and six females; whereas, the control group composition listed 15 males and one female. Consequently, the analysis was computed on the males and the total group. The only benefit to be deduced from testing the females involved a nonstatistical observation of the results obtained from the one control female subject, in contrast, to the six experimental females.

Review of Literature

Intentionally, the review exposes types of operant conditioning programs and its participants. According to the literature under examination, a wide range of subjects have become involved. The gamut included varying degrees of the following disorders: minimally brain injured, multi-handicapped, learning disabled, academically inadequate, mentally retarded, academically adequate, emotionally disturbed, dropouts, reading disabled, culturally deprived, delinquents, sociopaths, psychotics, neurotics, autistics, schizophrenics, lower and higher socioeconomic strata, behavioral problems, and masturbation tendencies. All these diagnoses and categories imply that tailor-made behavioral programs had to be developed; otherwise, their end result would have been failure.

The programs to be explained sight different goals. The validity of a program rests upon having goals and hopefully having shaping approximations to reach the ultimate behavior

desired. For operant conditioning to be relevant, a transfer to intrinsic reinforcement is expected instead of a continuation of extrinsic reinforcement. Axelrod (1971) recommends two procedures to stimulate transfer to the traditional classroom. They are: 1) precede the delivery of tokens with praise; and 2) use a prize as a delayed reinforcer.

Principles of operant methodology for learning disabilities in the classroom are: 1) behavior defined and specified; 2) behavior that showed learning reported; 3) behavior continuously assessed known degree of progress attained; 4) behavior affected by what; 5) behavior able to manipulate one variable or environment; and 6) behavior which has reached such heights that it can evaluate total programming effects (Lovitt, 1968).

Dykman (1970) conducted an experiment that compared middle class Caucasian boys that were academically adequate to those with learning disabilities. The median age was 10.6 years. The experimental learning disabled were divided into three groups: hyperactive, hypoactive, and normactive. It was hypothesized that children with learning disabilities as a group have a slower reaction time and would be slower in comprehending simple instructions when compared to the controls (academically adequate). Collectively, children with learning disabilities are not slower than controls in comprehending simple training instructions but hyperactive children with learning disabilities differed reliably from the controls. This explains that children with learning

disabilities can benefit from operant conditioning as much as normal children.

Token reinforcement is a principle of operant conditioning that is used to modify behavior. Tokens are objects or symbols that may be exchanged for objects or privileges which are reinforcing. Ten learning disabled students diagnosed as minimally brain injured and emotionally disturbed followed a token reinforcement program to improve their level of academic achievement. These students ranged from 10 to 13 years of age. Their tokens were converted into special privileges, weekly grades, and recess special benefits. Their performance did not reach an optimal development, although co-workers were used in implementing the project (Axelrod, 1971).

A study with six minimally brain injured males ranging from eight to 12 years attempted to control frustration reactions. They were in a special class situation and all involved had psychoneurological learning disabilities. Their experimental procedures called for: 1) a discussion of the meaning of the word frustration; 2) a reward entailed a star when controlled frustration with the formation of the letter "C" for control instead of explosive behavior; 3) after an accumulation of 25 stars a prize was given and a student came a step closer to the regular classroom; 4) a classroom chart recorded his behavior and its relation to his goal; and 5) the attainment of a goal supposed that the transfer concept would move to more adaptive behaviors in other areas of the classroom (Pollack, 1968).

Conditions were arranged to test the behavior of male mentally retarded defectives when given different amounts of cigarettes as rewards. Those engaged in this study were 74 institutionalized teenagers and adults. In order to qualify all had to smoke. They were divided into two reward groups with reinforcements of one and three cigarettes, respectively. The subjects were instructed to pull the lever on the manipulandum device. In return for their efforts they received different amounts of cigarettes. No significant results were found to distinguish between the different amounts or rewards. However, it appeared that those with higher mentalities reached extinction, behavior was more vigorous and persistent when reinforcement was lower (Ellis, 1962).

Ellis (1962) tried a second experiment with institutionalized male defectives with a chronological age range of eight to 27 years. The rewards varied in material composition and amount. Groups received one or three reinforcements of candy or cigarettes. Vigor was lowered with larger amounts of reward as happened in Ellis' first experiment. Extinction with higher IQ defectives tended to have them stop responding sooner; whereas, the lower subjects left the test before obtaining the available 20 rewards.

Two experiments were conducted with lower mentally retarded subjects. These trials used unconventional apparatus for taking of a typical two-choice task. The first experimental group consisted of 63 nonblind mongoloid and non-mongoloid children with a chronological age of eight to 16

years and a mental age extending from 2.10 to 4.6 years. They were in attendance at a private day school. The second experiment dealt with 60 imbecile mongoloid, non-mongoloid, and brain injured children of equal number. Their chronological and mental age characteristics followed suit. It was discovered that nonreinforcement of responses to irrelevant stimuli facilitated the acquisition of visual discrimination in noninstitutionalized imbecile children having a mental age of three to four-and-a-half years (Lobb, 1966).

An exercise machine experiment was conducted in a classroom setting. The moderate to severely retarded youngsters rode it for 15 minutes with 15 minute time off periods when rewarded with M and M candies, small plastic trinkets, and projected pictures which interested them the least. There were seven males and one female engaged in exercise. In age they ranged from 10 to 19 years. It was concluded that there was a clear and consistent difference between the use of the cycle when reinforcement and nonreinforcement periods were tried (Sechrest, 1968).

Seventy-one trainable mentally retardates were distributed proportionally into three groups of sequential age spans extending from eight to 21 years. The purpose of the program was to teach basic personal skills which would transfer to verbal and social skills. They began using food as a reinforcement but transferred to tokens. The tokens converted to privileges, cosmetics, food, movies, et cetera. Negative reward served as a reinforcer for deviant behavior.

Tokens were taken away. This plan worked but problems occurred when transfer was attempted to verbal and social skills. Fortunately, 12 older students from the 17 to 21 age range improved so much they were able to return to the community (Lent, 1968).

Axelrod (1971) explained a situation where severely retarded individuals excelled with the use of poker chips as tokens for the typical token rewards of candy and trinkets. Thirty-seven severely retarded children were divided into sections of six to 13 in one classroom; 33 out of 37 changed their habits and began to hang up coats, wait quietly for the teacher, and for their assignments.

Obscene conduct of 14 educable mentally retarded children was tested. The sex composition was split evenly. Rewards were dependent upon the behavior of the group as a unit. If there was a misbehavior, the class stayed for one minute during recess time. When this procedure was stopped, the baseline prevailed at a lower level of disturbance. Tokens worked to improve the behavior of severely mentally retarded children residing in a pre-school setting. The negative and positive use of tokens was enforced in the experiment (Axelrod, 1971).

Four different treatments were conducted with 60 mentally retarded institutionalized males. Their age spread from 12 to 35 years. Within the experiment the effects of reinforcement on reaction times were observed. The four groups were controlled by the following rewards for their speed in

reacting: 1) a bell sound; 2) a verbal praise for "good" was given; 3) a bell sounded and two pennies were given; and 4) a response of no reward or feedback was given. The fourth group (control) experienced a decrement in performance of its subjects while the money-bell group had a faster reaction time for its subjects, in comparison, to the bell only and "good" verbal praise groups (Baumeister & Ward, 1967).

Linde (1962) gives some vital information about programs tried with mental retardates in a United Association Workshop. Within the Workshop the negative and positive reinforcements were advocated. Some helpful suggestions were: 1) used half-hour periods with rewards that did not exceed a nickel; 2) gave weekly bonuses for high performance work; 3) rewarded quality behavior; 4) gave an increment in weekly pay if growth was visible; 5) made stiffer behavior goals if progress was too rapid; 6) deducted money when undesirable behavior appeared; 7) gave a basic wage; and 8) received short term progress tokens. Mentally retarded individuals needed motivation. Tokens were not as successful as extrinsic rewards or promotional schemes. To win a subject over to motivation he hung a photograph of the worker that completed the most commendable work and pointed out his superior work in front of a co-worker mentioning that this other worker had the same potential to produce but just had not reached his capacity. Before this motivational campaign was undertaken it was important to know the ability of the

subjects to be selected out. Overrating or underrating did not help the mentally retarded subject. Linde (1962) suggested proceeding with caution in endeavors of motivation.

Bricker (1970) contends that mental retardation has developmental behavioral deficits which can be aided by programs geared to fit the subject. The three stages that develop a valid program are: 1) a small number of subjects being worked with over long periods of time with planned programs; 2) a widespread application of the program devised that lends itself to sequences of training to reach approximations of the expected performance levels; and 3) an efficient well-organized program that clearly explains its nature so untrained persons can duplicate it.

In order to experiment with socially maladjusted subjects a baseline was found to be more reputable when judging the validity of a program. If the experimenters returned to the original situation without reinforcement and found a change in the rate of occurrence of the behaviors, this is progress. In other words the baseline (rate of occurrence) changed. In a study with socially maladjusted from the third and fourth grades, this worked. Twelve children participated in this trial. An equal number came from the two grades listed above. If they practiced appropriate behavior (staying in their seats, facing front, et cetera) tokens were awarded. They could purchase items with these. Before the baseline showed deviant behavior occurring 54% of the time. With tokens it had diminished

to 27.8% of the time. When tokens were removed the baseline was 41.5%. This proves that the behavior change was not due to the passage of time, the maturation of the subject, nor the increase of teacher effectiveness (Axelrod, 1971).

With academically retarded subjects the doubling of points worked well. These students were two years below grade level on the Stanford Achievement Test. In a comparison of the experimental group to the control group, the experimental group surpassed them by .7 of a year in academic progress (Axelrod, 1971).

Axelrod (1971) suggests programmed instruction and token reinforcement with reading disabled elementary school boys that were of average intelligence. Three differently diagnosed (mentally retarded, emotionally disturbed, culturally deprived) poor readers on the basis of achievement tests were in the seventh, eighth, and special education divisions. Their average age was 14.6 years. All 36 were evenly divided into experimental and control groups. Experimental subjects were tutored in instructional reading by mothers and high school seniors. This tutoring was geared so the amount of reinforcement given per reading session would elicit better performance for the same reinforcement. The experimental group performed better on the 100 words than the controls because they were tutored and received reinforcements for their efforts. Results showed that reinforcement procedures for test administration produced significant effects on the California Achievement Test. If they randomly responded to test questions, they were punished. This is just another example of

the success that negative and positive reinforcements have when used simultaneously in a program of operant conditioning (Staats, 1967).

Hewett's (1968) use of tangible rewards with severely disturbed children for 15 years showed learning gratification. His programs have been outlined in three phases of rewards--tangibles, privilege time, and graphing check marks.

The philosophy of the program discussed intended to prepare the child for re-entry into the regular class. The emphasis focused on the total behavior--academic and social. It was felt that through such a program the student would return to the regular classroom adequately prepared to adjust to its demands (Glavin, Quay, & Werry, 1971).

Two groups of eight emotionally disturbed students took part in the above experiment. All students came from a lower socioeconomic background with the ethnic percentage being 50% Afro-American. These disordered children were kept in two self-contained classroom environments. Precise goals were outlined for the two years of observation. For 1967 deviant behavior was to be eliminated while attending behavior was cultivated. In 1968 an emphasis on the academic was to reign. A program was carefully outlined to carry out this 1968 plan. Points used were: 1) give more time to activities; 2) use shorter time segments of concentrated academic work, for example, 15 minute time periods for specific tasks; 3) utilize group instruction with students on similar academic levels relying on appropriate reinforcers;

4) add a program director to the staff which will make individual instruction more available to the students; 5) have free time centers at corners of the room with different high interest level activities; 6) experiment with individual or small group tutoring at opposite areas of the classroom; 7) divide desks by partitions where their best work can be displayed; 8) graph each child's personal progress according to the daily tokens earned; 9) reinforce with prizes that are on exhibit; and 10) implement standard texts and workbooks with reading material of high interest, low vocabulary, and adaptable to 15 minute time segments (Glavin et al., 1971).

The reinforcement schedule was explicit. It ran as such: 1) checkmarks were used for the evaluation of 15 minute work segments; 2) child received a positive verbalization by the teacher after charting; 3) nature and value of reinforcement was uncertain for older conduct problem children as research has shown the need for excitement and novelty in their reinforcers; 4) rules violated deserved a warning for the first offense but if continued sent to the time out room, a closed in cubicle (Glavin et al., 1971).

In 1968 the behavior and the academic both progressed more than in the 1967 program. The arithmetic mean for 1968 rose 1.7 years while in 1967 it advanced only .1 of a year. This success has been attributed to the emphasis on the positive, instead, of the negative behavior and academic performance. Two facets of the program that aided the positive over

the negative reinforcement (isolating for long periods of time) were: 1) using carefully chosen academic tasks for individual seat work; 2) using small group activities; and 3) employing team teaching techniques (Glavin et al., 1971).

Often children with severe problems in learning reached their situation through organic malfunction or parental influence. They experienced sequential failure decrements in their learning skills. Leff (1968) contends that if their environment is ordered sufficiently they can successfully learn to manipulate it. He bases this statement on the use of carefully specified goals that allow underdeveloped behavior to be eliminated and adaptive skills and habits imparted. He achieved success by using this type of operant conditioning with autistic children. For a 13 year old boy gumdrops served as rewards for verbalizations. In an early infantile autism case, the experimenter made the child verbalize his demands before they were gratified.

Hewett (1964) used four stages in order to get an autistic child to read and write. They were: 1) establish rapport with the teacher; 2) have the child work at an activity; 3) use partial reinforcement; and 4) increase his interest in his environment through successes. Here the stress has been placed on individualizing with the child. Once this has been accomplished the teacher knows how to satisfy the child's appetite in learning and can begin to teach him adequately. This has already been mentioned a number of times but it is vital to learning and deserves reiterating.

A program was established to elicit communication skills from a four-and-a-half year old Caucasian autistic boy. Hewett (1965) laid the following plan: 1) establish eye contact; 2) engage in imitation of the teacher's hand movement to establish social contact; 3) train the child in speech by repetition with reinforcements of candy and a light flash; 4) transfer this verbal behavior to the ward. As one can tell the basic fundamentals of Skinner's operant conditioning have been applied--shaping, transfer.

In a hospital program there were conflicts over the program being used on a six year old autistic male. The researchers and the staff did not agree on the method of conditioning in use. Food deprivation was used successfully in spite of the conflicts (Morrison, Mejia, & Miller, 1968). Perhaps there would have been more progress if no conflicts had existed.

Fineman (1968) had good results when he used 10-five minute sessions for verbalizations and 10-five minute sessions with manipulative activities. The four-and-a-half year old nonverbal autistic child was rewarded with a visual color display each time he verbalized. The results moved from 20.8 responses per session to 50.8 responses with rewards.

In teaching reading to an autistic boy, Hewett (1964) learned that this child had a preference for self-directed over socially directed activities. The plan for this child was: 1) rapport between teacher and child that was rewarded with gumdrops; 2) manuvering picture cards from

left to right; 3) matching word ball with picture ball; 4) moving on to picture cards then puzzles, et cetera; 5) learning to write with a flannel board. Once this child learned the rudimentary skills of reading and writing his interest was heightened in his environment thus making him more accessible to social control.

Noffsinger (1971) experimented with 45 boys of average intelligence. They were divided into three categories according to Quay's Behavior Problem Checklist: anxious-withdrawn, nondeviators, hyperactive-aggressive. The subjects received different rewards which were: 1) monetary with verbal comments; 2) verbal support alone; and 3) no apparent reward neither verbal nor social. The hyperactive-aggressive group scored better on the 15 minute testing. They were rewarded verbally. The anxious-with-drawn performed better for a money reward. The nondeviant behavior group experienced no different reaction to money and verbal reinforcement but differed significantly in their reaction to no reward. This only reinforces the theory that different individuals react in their own way; therefore, needing varying rewards.

Clement (1968) feels that in working with behavior problem children it is essential to list the behaviors that are to be reinforced. He used three different means of reinforcement with 11 boys having shy, anxious, withdrawn behavior. They were divided into three unequal groups since their reinforcements differed. The three groups ran:

token, therapist, and control (nonreinforcement). On this first trial run the token group improved on four behavior measures, the therapist on two measures, and the control on no measures. In the second trial the token changed on 42% of the measures, the therapist on 29% of the measures, and the controls on 25% of the measures. In another of his studies he worked with six, 11 year old boys in a clinical setting. They were rewarded for expressing a feeling of their own or another member's feeling. It proved successful with another child having behavior problems. Ten behaviors were identified by the teacher which she wanted eliminated. The counselor talked with the child. They agreed that each time one of the 10 behaviors occurred he would receive a checkmark. If he wanted to see his therapist for sessions, he would have to stop these behaviors. This was a strong incentive for him to improve his behavior since he had a very good relationship with his therapist and did not like to miss his sessions.

Tyler and Brown (1968) found that contingent (according to scores earned) reinforcement was more successful with 15 court committed boys ranging in age from 13 to 15 years rather than noncontingent (straight salary) reinforcement. The boys were separated into two groups under two phases--contingent, noncontingent reinforcement. They were paid in tokens for their best academic test scores. The hypothesis was supported by the performance shown by the boys when they achieved more under contingent reinforcement.

Students from lower and higher socioeconomic strata were observed under varying reward systems. The reward priorities of 156 lower socioeconomic six grade students were compared to that of 94 higher socioeconomic six grade students. All students were divided into experimental and control groups within their socioeconomic classification. The experimental groups within the lower socioeconomic students performed better when they were offered an extrinsic reward. The higher socioeconomic students did not perform better when given extrinsic rewards. This implied that many of the schools turn off lower socioeconomic students by their intrinsic rewards of grades, social approval, and honor societies (Higgins & Archer, 1968).

Wagner (1968) tells how the compulsive public masturbation tendencies of an 11 year old girl of normal intelligence were eliminated. The teacher began by carefully observing the child's tendencies and counting how often they were exhibited within an hour. The teacher devised a way to reward the child with something she liked to do. The reward schedule included being rewarded for an hour of abstinence in the morning and half-an-hour in the afternoon.

Rewards bestowed were: 1) being able to correct papers and other student aide activities; and 2) having a note sent home to her parents when she went a full day without masturbation in class. Her parents were in on the program and would reward her at home for successful abstinence. Negative reinforcement was used by the teacher by calling

her name aloud when this behavior was seen. After seven months this behavior ended.

While working with 80 sociopathis youthful offenders, Persons (1968) learned that verbal conditioning elicited better feeling responses when a peer group examiner was used over an adult examiner.

The literature weighs heavily in favor of operant conditioning programs specifying that the subject under study must be analyzed thoroughly to ascertain his priorities in rewards. In order for an individual to be distracted from inappropriate behavior while also satisfying him, the promised reward calls for involving him in something he likes to do (Wagner, 1968). Realistically, success happens when a prescription has been written for the subject. A prescription outlines a flexible plan developed for a specific subject. If necessary the plan can be diversified so it meets the subject's needs.

CHAPTER II

RESULTS

Introduction

In order to adequately judge the success of the two programs, reward-team teaching vs. traditional, a comparison was made of the varied disciplines examined on the pre- and posttests. Through the analysis, significant increments in academic achievement were anticipated.

Twenty-two experimental (E) subjects from Benjamin Franklin Junior High were compared to 16 control (C) subjects from W. T. Browne (C_1) and John B. Hood (C_2). The C group was equally divided. In order to evaluate the results an analysis of variance (ANOVA), two factor-mixed design, with repeated measures on one factor was computed. The ANOVA design assigned subjects to several groups. In this study, there was an experimental group and two control groups. The subjects' performance was measured by pre- and posttests to determine the effects of the two programs that lasted for a year's duration. This design enabled: 1) a comparison of the overall performance of the groups; 2) an evaluation of performance changes from March 1970 to March 1971; and 3) an evaluation of the effects of the programs in relation to a year's passage of time (Bruning).

An F-test was conducted since ANOVA had shown a significant interaction on the ratios of the mean squares to determine significance of the groups vs. pre- and posttests. The F-test found that of the three groups at least two differed significantly; the problem to determine which pairs differed. The Duncan's New Multiple Range Test (hereafter referred to as Duncan's) continued to test for the most significant improvement among the groups.

A Duncan's was used because there were more than two groups. ANOVA calculated the means which were used to find significance. If there are more than two group means, this becomes complex: e.q., with three groups means, it may be that all three differ, but which differs. The simple ANOVA cannot distinguish between them; then it is vital to conduct the Duncan's to ascertain which group improved the most over the testings. On the Duncan's Tables, lines are drawn from means to means to show nonsignificant difference between the C and E groups.

The instrument used in the study, the California Achievement Test, concerned itself with three broad academic disciplines: reading, arithmetic, and language. The disciplines were subdivided into: reading vocabulary and comprehension, arithmetic reasoning and fundamentals, and language mechanics and spelling. In addition the disciplines were totaled and a total of all three disciplines and the total battery were given. An analysis was computed on each area within a discipline, on totals of the disciplines, and the total battery. (An analysis involves all three used: ANOVA, F-test, and Duncan's).

Significant differences would be indicated between groups and between tests from this design of ANOVA; however, for this study, overall differences "Between groups" and "between pre- and posttests" were not considered as important as the manner in which the groups changed from pre- to posttest. A significant interaction between groups and tests indicates information as to relative change in performance, whereas a "between pre- and posttests" significance ignores or averages the groups and indicates whether overall performance was different on pre- and posttests; a "between groups" significance ignores the tests and indicates whether overall group performance was different. For these reasons, interpretations of this experiment will concentrate on the interaction term from the ANOVA (groups X pre- and posttest) and the subsequent Duncan's result.

Results of Pre- and Posttests Performance

Table 1 shows group means, standard deviations, and the results of the Duncan's for the reading vocabulary subdivision. Both pre- and posttests, of the E group were significantly above both pre- and posttests of the C groups; however, none of the groups significantly increased their performance in vocabulary from their own pretest level.

A significant difference between pre- and posttests was found. Generally, when grouping was disregarded, performance was higher on the second trial of testing. The E group scores differed significantly from the C when trials were disregarded, indicating an overall superiority of the E group. Table 1 and Figure 2 illustrate the differences in academic progressions of the E and C groups from pre- to posttest.

FIGURE II GROUP MEAN SCORES OF THE PRE- AND POSTTEST FROM THE VOCABULARY SUBDIVISION OF THE CALIFORNIA ACHIEVEMENT TEST

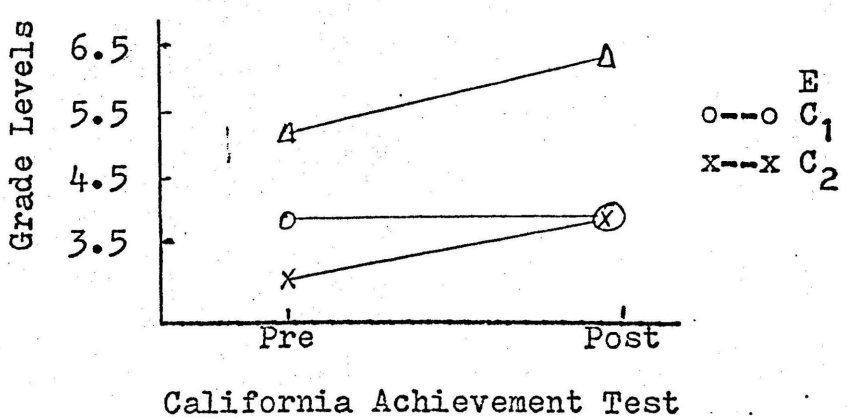


TABLE I

GROUP MEANS, STANDARD DEVIATIONS, AND RESULTS OF DUNCAN'S NEW MULTIPLE RANGE TEST FOR THE READING VOCABULARY OF THE CALIFORNIA ACHIEVEMENT PRE- AND POSTTESTS FOR THE EXPERIMENTAL AND CONTROL GROUPS

		Pre	Post
E	X	5.3	6.4
	s	1.8	2.8
C_1	X	3.8	3.9
	s	1.3	1.5
C_2	X	3.3	3.9
	s	1.8	2.6

DUNCAN'S COMPARISON OF MEANS

C_2(Pre)	C_1(Pre)	C_1,C_2(Post)	E(Pre)	E(Post)
3.3	3.8	3.9	5.3	6.4

Generally, the E group displayed a greater increase in vocabulary scores when a comparison of the two tests of the groups; however, this gain was not found to be statistically significant.

Group means, standard deviations, and Duncan's calculations on the reading comprehension test are presented in Table 2. The E group did not change significantly as compared to the C group from the pre- to the post-test as the Duncan's Comparison of means (Table 2) clearly displays. Figure 3 graphically exposes the amount of increase from pre- to posttest, and indicates that no significant change occurred between the E and C groups pre- and posttest scores.

FIGURE III GROUP MEAN SCORES OF THE PRE- AND POSTTEST FROM THE COMPREHENSION SUBDIVISION OF THE CALIFORNIA ACHIEVEMENT TEST

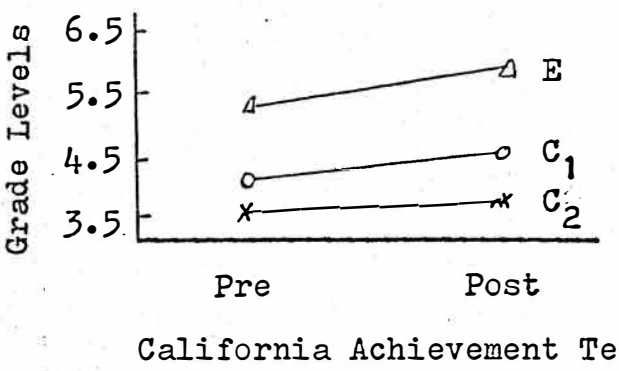


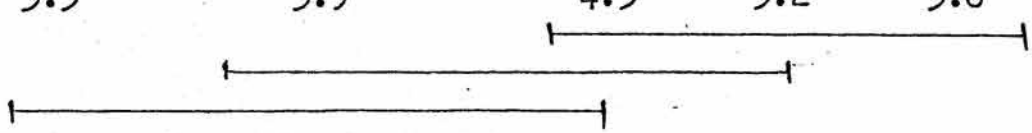
TABLE II

GROUP MEANS, STANDARD DEVIATIONS, AND RESULTS OF DUNCAN'S NEW MULTIPLE RANGE TEST FOR THE READING COMPREHENSION OF THE CALIFORNIA ACHIEVEMENT PRE- AND POSTTESTS FOR THE EXPERIMENTAL AND CONTROL GROUPS

		Pre	Post
E	X	5.2	5.8
	s	1.6	2.1
C_1	X	3.9	4.5
	s	1.5	1.4
C_2	X	3.5	3.9
	s	0.9	0.8

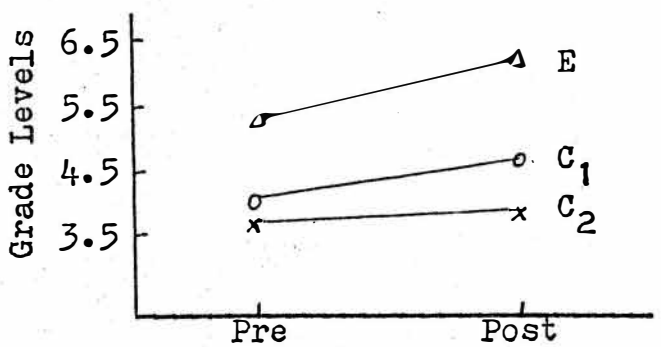
DUNCAN'S COMPARISON OF MEANS

C_2(Pre)	C_1(Pre) & C_2(Post)	C_1(Post)	E(Pre)	E(Post)
3.5	3.9	4.5	5.2	5.8



A summary of the reading total (see Table 3) shows the E group changed significantly from pre- to posttest, but the C groups did not. As Figure 4 indicates, the posttest findings for the C_1 group were not significantly different from the pre-test E group scores, which shows that this C groups final performance in reading scores was equilavent to the pre-test performance of the E group.

FIGURE IV GROUP MEAN SCORES FOR THE PRE- AND POSTTEST FROM THE READING TOTAL DIVISION OF THE CALIFORNIA ACHIEVEMENT TEST



California Achievement Test

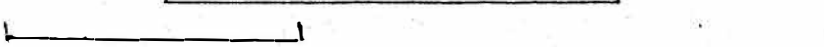
TABLE III

GROUP MEAN, STANDARD DEVIATIONS, AND RESULTS OF DUNCAN'S NEW MULTIPLE RANGE TEST FOR THE READING TOTAL OF THE CALIFORNIA ACHIEVEMENT PRE- AND POSTTEST FOR THE EXPERIMENTAL AND CONTROL GROUPS

		Pre	Post
E	X	5.2	6.2
	s	1.7	2.2
C_1	X	3.9	4.4
	s	1.4	1.4
C_2	X	3.5	3.9
	s	0.8	0.9

DUNCAN'S COMPARISON OF MEANS

C_2(Pre)	C_1(Pre) C_2(Post)	C_1(Post)	E(Pre)	E(Post)
3.5	3.9	4.4	5.2	6.2



From all appearances, no group, using the arithmetic reasoning subdivision scores, significantly improved from the pre- to posttest as represented by the Duncan's Comparison of Means in Table 4. An observation of the progressions from pre- to posttest in Figure 5 showed that the groups almost run parallel. Evidently, this indicated that none of the groups' overall performance changed enough to be significantly different from the change shown by the other groups.

FIGURE V GROUP MEAN SCORES FOR THE PRE- AND POSTTEST FROM THE REASONING SUBDIVISION OF THE CALIFORNIA ACHIEVEMENT TEST

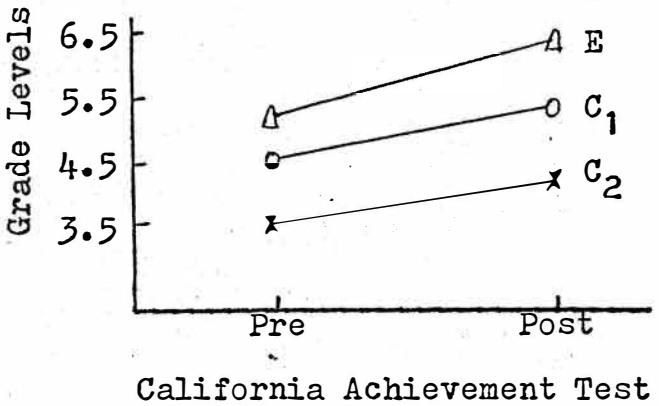


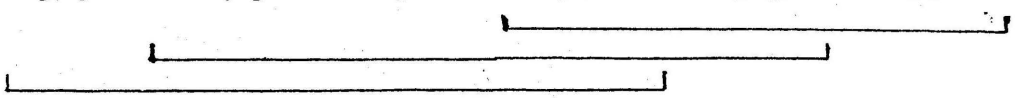
TABLE IV

GROUP MEANS, STANDARD DEVIATIONS, AND RESULTS OF DUNCAN'S NEW MULTIPLE RANGE TEST FOR THE ARITHMETIC REASONING OF THE CALIFORNIA ACHIEVEMENT PRE- AND POSTTEST FOR THE EXPERIMENTAL AND CONTROL GROUPS

		Pre	Post
E	X	5.3	6.0
	s	1.5	1.8
C_1	X	4.6	5.2
	s	1.8	0.9
C_2	X	3.5	4.3
	s	1.1	0.7

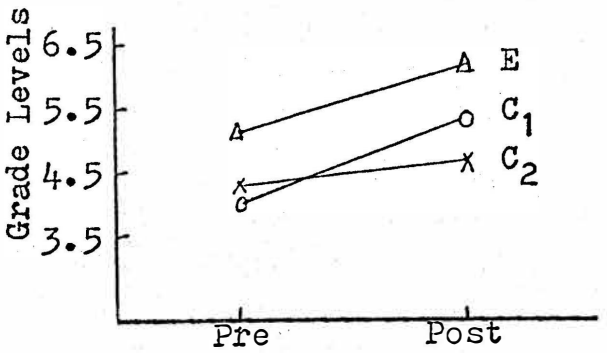
DUNCAN'S COMPARISON OF MEANS

C_2(Pre)	C_2(Pre)	C_1(Pre)	C_2(Post)	E(Pre)	E(Post)
3.5	4.3	4.6	5.2	5.3	6.0



While weighing the elements involved on the arithmetic fundamentals subdivision an indication of a significant change in scores was not established through the ANOVA and Duncan's computations. Table 5 shows that no group significantly improved from pre- to posttest in this arithmetic fundamentals scores, while Figure 6 reiterates this fact graphically.

FIGURE VI GROUP MEAN SCORES OF THE PRE- AND POSTTEST FROM THE FUNDAMENTALS SUBDIVISION OF THE CALIFORNIA ACHIEVEMENT TEST



California Achievement Test

TABLE V

GROUP MEANS, STANDARD DEVIATIONS, AND RESULTS OF DUNCAN'S NEW MULTIPLE RANGE TEST FOR THE ARITHMETIC FUNDAMENTALS OF THE CALIFORNIA ACHIEVEMENT PRE- AND POSTTEST FOR THE EXPERIMENTAL AND CONTROL GROUPS

		Pre	Post
E	X	5.2	5.9
	s	1.4	1.6
C_1	X	4.1	5.1
	s	1.2	0.7
C_2	X	4.2	4.6
	s	0.8	0.7

DUNCAN'S COMPARISON OF MEANS

C_1(Pre)	C_2(Pre)	C_2(Post)	C_1(Post)	E(Pre)	E(Post)
4.1	4.2	4.6	5.1	5.2	5.9

No group showed significant improvement from pre- to posttest on the arithmetic total division. It was noted that the posttest of the $\underline{C}_1$ was statistically equivalent to the E group pre- and posttest scores. Visually, the means scores in Figure 7 depict this equivalency, as the test scores of the E and $\underline{C}_1$ groups seem parallel, and the $\underline{C}_1$ posttest result in about the same as the E group's scores. Table 6 elaborates on the comparisons of means of all groups, and indicates their nonsignificance.

FIGURE VII GROUP MEAN SCORES OF THE PRE- AND POSTTEST FROM THE TOTAL ARITHMETIC DIVISION OF THE CALIFORNIA ACHIEVEMENT TEST

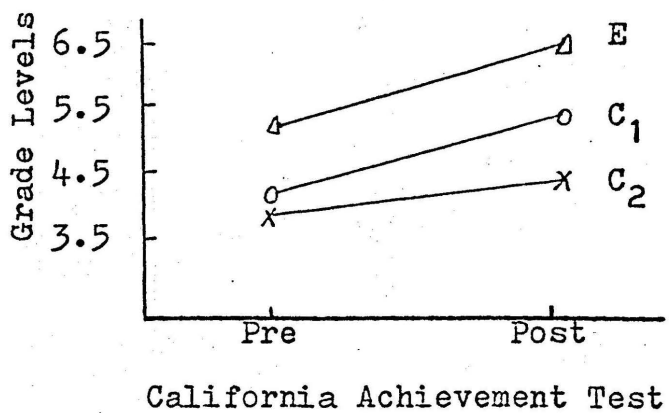


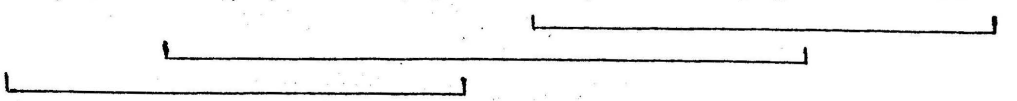
TABLE VI

GROUP MEANS, STANDARD DEVIATIONS, AND RESULTS OF DUNCANS'S NEW MULTIPLE RANGE TEST FOR THE ARITHMETIC TOTAL OF THE CALIFORNIA ACHIEVEMENT PRE- AND POSTTESTS FOR THE EXPERIMENTAL AND CONTROL GROUPS

		Pre	Post
E	X	5.3	6.0
	s	1.4	1.7
C_1	X	4.4	5.2
	s	1.2	0.5
C_2	X	4.0	4.5
	s	1.0	0.7

DUNCAN'S COMPARISON OF MEANS

C_2(Pre)	C_1(Pre)	C_2(Post)	C_1(Post)	E(Pre)	E(Post)
4.0	4.4	4.5	5.2	5.3	6.0



Mechanics of language scores were not significantly changed among E and C groups test scores to merit a statistically significant conclusion. A check shows the Duncan's Comparison of Means, this nonsignificance can be readily seen (Table 7); whereas, the graph (Figure 8) may tend to be misleading since the E group's advancement from the pre- to posttest seems higher than C groups on the testing measures; however, this rise was not a statistically significant improvement according to the ANOVA.

FIGURE VIII GROUP MEAN SCORES OF THE PRE- AND POSTTESTS FROM THE MECHANICS SUBDIVISION OF THE CALIFORNIA ACHIEVEMENT TEST

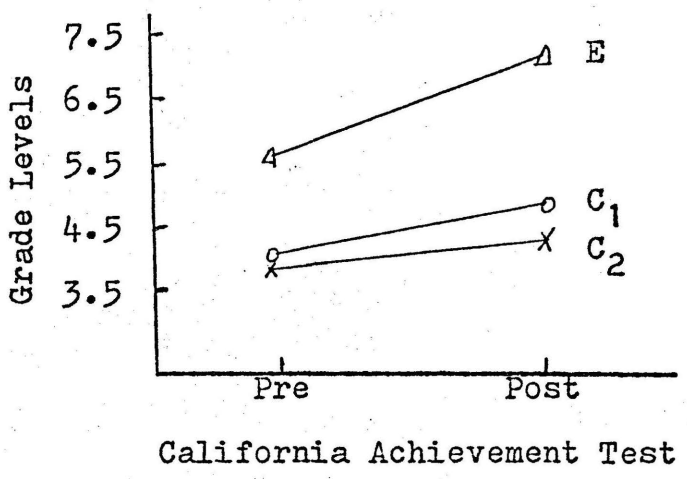


TABLE VII

GROUP MEANS, STANDARD DEVIATIONS, AND RESULTS OF DUNCAN'S NEW MULTIPLE RANGE TEST FOR THE LANGUAGE MECHANICS OF THE CALIFORNIA ACHIEVEMENT PRE- AND POSTTESTS FOR THE EXPERIMENTAL AND CONTROL GROUPS

		Pre	Post
E	X	5.5	6.7
	s	2.4	2.4
C_1	X	3.8	4.7
	s	0.7	0.4
C_2	X	3.7	4.3
	s	0.8	1.1

DUNCAN'S COMPARISON OF MEANS

C_2(Pre)	C_1(Pre)	C_2(Post)	C_1(Post)	E(Pre)	E(Post)
3.7	3.8	4.3	4.7	5.5	6.7

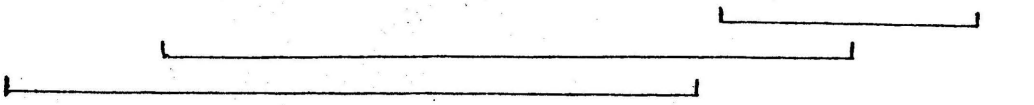


Figure 9 graphically portrays the lack of significant improvement in the spelling scores from the pre- and post-test of the E and C groups. The Means Comparison of the Duncan's shows the nonsignificant academic gain of all groups (see Table 8).

FIGURE IX GROUP MEAN SCORES OF THE PRE- AND POSTTEST FROM THE SPELLING SUBDIVISION OF THE CALIFORNIA ACHIEVEMENT TEST

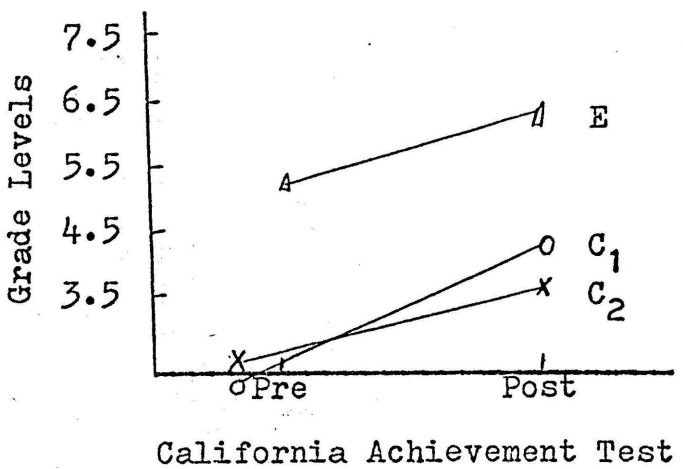


TABLE VIII

GROUP MEANS, STANDARD DEVIATIONS, AND RESULTS OF DUNCAN'S NEW MULTIPLE RANGE TEST FOR THE LANGUAGE SPELLING OF THE CALIFORNIA ACHIEVEMENT PRE- AND POSTTEST FOR THE EXPERIMENTAL AND CONTROL GROUPS

		Pre	Post
E	X	5.1	5.8
	s	1.9	2.0
C_1	X	2.9	4.0
	s	1.0	0.9
C_2	X	3.0	3.7
	s	1.0	1.4

DUNCAN'S COMPARISON OF MEANS

C_1(Pre)	C_2(Pre)	C_2(Post)	C_1(Post)	E(Pre)	E(Post)
2.9	3.0	3.7	4.0	5.1	5.8

The ANOVA and the Duncan's indicated that no significant change occurred from pre- to posttest for the total language division. Table 9 diagrams the outcomes of the Duncan's Comparison of Means, and Figure 10 visually shows the non-significant progressions of all the groups' academic achievement.

FIGURE X GROUP MEAN SCORES OF THE PRE- AND POSTTEST FROM THE LANGUAGE TOTAL OF THE CALIFORNIA ACHIEVEMENT TEST

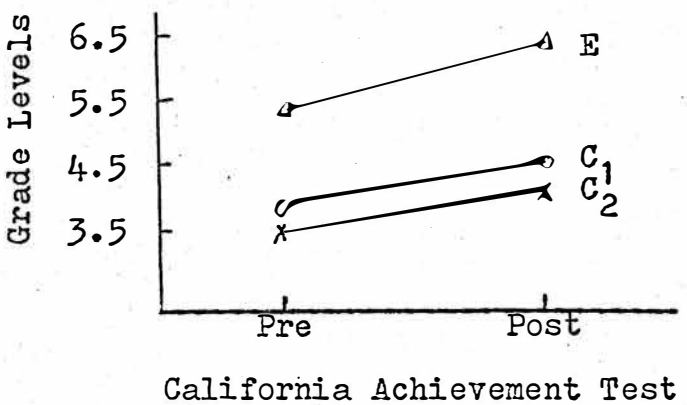


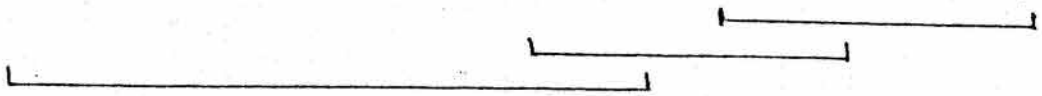
TABLE IX

GROUP MEANS, STANDARD DEVIATIONS, AND RESULTS OF DUNCAN'S NEW MULTIPLE RANGE TEST FOR THE LANGUAGE TOTAL OF THE CALIFORNIA ACHIEVEMENT PRE- AND POSTTEST FOR THE EXPERIMENTAL AND CONTROL GROUPS

		Pre	Post
E	X	5.3	6.3
	s	1.8	2.2
C_1	X	3.7	4.5
	s	0.7	0.4
C_2	X	3.5	4.2
	s	0.8	1.1

DUNCAN'S COMPARISON OF MEANS

C_2(Pre)	C_1(Pre)	C_2(Post)	C_2(Post)	E(Pre)	E(Post)
3.5	3.7	4.2	4.5	5.3	6.3



Statistically, the E group showed significant total battery improvement from pre- to posttest; whereas, neither C groups achieved significant improvement from pre- to posttest. An indication of the E groups' improvement is displayed in both Figure 11 and Table 10. Even though the E group was significantly above both C groups in "terms" of total battery posttest scores, the results indicated that the E group significantly increased their total battery scores; whereas, neither C group showed significant improvement.

FIGURE XI GROUP MEAN SCORES OF THE PRE- AND POSTTEST FROM THE TOTAL BATTERY OF THE CALIFORNIA ACHIEVEMENT TEST

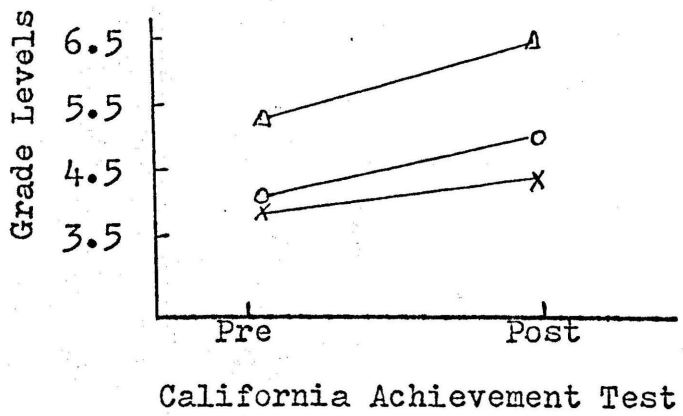


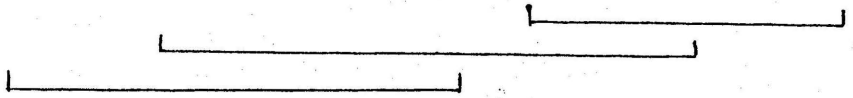
TABLE X

GROUP MEANS, STANDARD DEVIATIONS, AND RESULTS OF DUNCAN'S NEW MULTIPLE RANGE TEST FOR THE TOTAL BATTERY OF THE CALIFORNIA ACHIEVEMENT PRE- AND POSTTEST FOR THE EXPERIMENTAL AND CONTROL GROUPS

		Pre	Post
E	X	5.2	6.2
	s	1.5	1.9
C_1	X	4.0	4.7
	s	1.0	0.7
C_2	X	3.8	4.3
	s	0.8	0.9

DUNCAN'S COMPARISON OF MEANS

C_2(Pre)	C_1(Pre)	C_2(Post)	C_1(Post)	E(Pre)	E(Post)
3.8	4.0	4.3	4.7	5.2	6.2



CHAPTER III

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

A pre- and posttest of the California Achievement Test was administered to 22 experimental (E) subjects and 16 (C) subjects. The subjects were junior high school students in minimally brain injured special education classes within the Dallas Independent School District. The E group participated in an operant conditioning-team teaching program at Benjamin Franklin Junior High School and the C groups participated in traditional programs at W. T. Browne and John B. Hood Junior High Schools. The achievement tests were given in March of 1970 and 1971 by the Special Education Department of the Dallas Independent School District. Using the results of a pre- and posttest, an analysis of variance (ANOVA), two factor mixed design, with repeated measures on one factor was computed. A Duncan's New Multiple Range Test (Duncan's) determined which specific groups differed significantly on each of the ten measures observed. Interpretations of the experiment concentrated on the interaction term from the ANOVA and the Duncan's, to ascertain, whether one groups' performance significantly improved from pre- to posttest.

The results of the ANOVA and the Duncan's indicated a statistically significant improvement for the E group in

the reading total scores, and the combined total battery scores of the California Achievement Test.

Conclusions

An experiment that examines a larger sample is more representative of the population being observed. Although it is difficult to generalize from the small sample, the investigator concluded that the experimental group improved in academic achievement on two measures of the California Achievement Test, the Reading Total and the Total Battery; whereas, the control groups did not improve significantly in academic achievement on any of the 10 measures examined. The improvement appears to reflect on the Skinnerian operant conditioning-team teaching program developed at Benjamin Franklin Junior High School; in other words it appeared, from the statistical evaluation of this study, that the only single achievement component of the California Achievement Test which showed significant improvement for the E group was Reading Total score; results of the experimental program seem to be reflected in overall change in a number of components which when combined yield significant changes in the Total Bettery Scores.

Recommendations

In view of the results of this study, the investigator makes the following recommendations:

1) An extended study would more adequately ascertain the changes in measured achievement.

2) The use of an instrument to assess the social aspect of the adolescents' development would give a more concise evaluation of the total effect of the operant conditioning-team teaching program.

3) Further study using a larger sample to determine the effects of an operant conditioning-team teaching program for the minimally brain injured adolescent.

4) A thorough examination of the methods used by the teachers involved in the experimental operant conditioning program.

5) A more controlled testing environment for the groups involved would provide similarity in examiners, time, and place.

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APPENDICE A

ANALYSIS OF VARIANCE FOR THE EXPERIMENTAL AND CONTROL GROUPS ON PRE- AND POSTTESTS OF THE CALIFORNIA ACHIEVEMENT TEST'S READING VOCABULARY SUBDIVISION

Source	df	SS	MS	F
Between All Subjects	37	326.648		
Between Groups	2	82.553	41.277	6.43
Error Between	35	244.095	6.424	
Within All Subjects	38	46.120		
Between Tests	1	11.842	11.842	13.280
Groups X Tests (Pre & Post)	2	3.070	1.535	1.72
Error Within	35	31.208	.892	
Total	75	372.768		

ANALYSIS OF VARIANCE FOR THE EXPERIMENTAL AND CONTROL GROUPS ON PRE- AND POSTTESTS OF THE CALIFORNIA ACHIEVEMENT TEST'S READING COMPREHENSION SUBDIVISION

Source	df	SS	MS	F
Between All Subjects	37	210.236		
Between Groups	2	47.596	23.798	5.12
Error Between	35	162.640	4.647	
Within All Subjects	38	29.950		
Between Trials	1	6.368	6.368	9.55
Groups X Tests (Pre & Post)	2	.252	0.146	0.22
Error Within	35	23.330	.667	
Total	75	240.186		

ANALYSIS OF VARIANCE FOR THE EXPERIMENTAL AND CONTROL GROUPS ON PRE- AND POSTTESTS OF THE CALIFORNIA ACHIEVEMENT TEST'S READING TOTAL DIVISION

Source	df	SS	MS	F
Between All Subjects	37	242.282		
Between Groups	2	59.729	29.865	5.73
Error Between	35	182.553	5.216	
Within All Subjects	38	31.265		
Tests	1	13.558	13.558	29.35
Groups X Tests (Pre & Post)	2	1.545	0.773	1.67
Error Within	35	16.162	0.462	
Total	75	273.547		

ANALYSIS OF VARIANCE FOR THE EXPERIMENTAL AND CONTROL GROUPS ON PRE- AND POSTTESTS OF THE CALIFORNIA ACHIEVEMENT TEST'S ARITHMETIC REASONING SUBDIVISION

Source	df	SS	MS	F
Between All Subjects	37	163.344		
Groups	2	35.142	17.571	4.80
Error Between	35	128.202	3.663	
Within All Subjects	38	37.785		
Tests	1	9.951	9.951	12.55
Groups X Tests (Pre & Post)	2	0.095	0.048	0.06
Error Within	35	27.739	0.793	
Total	75	201.129		

ANALYSIS OF VARIANCE FOR THE EXPERIMENTAL AND CONTROL GROUPS ON PRE- AND POSTTESTS OF THE CALIFORNIA ACHIEVEMENT TEST'S ARITHMETIC FUNDAMENTALS SUBDIVISION

Source	df	SS	MS	F
Between All Subjects	37	107.032		
Groups	2	22.019	11.010	4.53
Error Between	35	85.013	2.429	
Within All Subjects	38	37.335		
Tests	1	8.964	8.964	11.38
Groups X Tests (Pre & Post)	2	0.783	0.392	0.50
Error Within	35	27.588	0.788	
Total	75	144.367		

ANALYSIS OF VARIANCE FOR THE EXPERIMENTAL AND CONTROL GROUPS ON PRE- AND POSTTESTS OF THE CALIFORNIA ACHIEVEMENT TEST'S TOTAL ARITHMETIC DIVISION

Source	df	SS	MS	F
Between All Subjects	37	121.427		
Groups	2	26.169	13.085	4.81
Error Between	35	95.258	2.722	
Within All Subjects	38	33.405		
Tests	1	7.642	7.642	10.47
Groups X Tests (Pre & Post)	2	0.214	0.107	0.15
Error Within	35	25.549	0.730	
Total	75	154.832		

ANALYSIS OF VARIANCE FOR THE EXPERIMENTAL AND CONTROL GROUPS ON PRE- AND POSTTESTS OF THE CALIFORNIA ACHIEVEMENT TEST'S LANGUAGE MECHANICS SUBDIVISION

Source	df	SS	MS	F
Between All Subjects	37	300.739		
Groups	2	76.292	38.146	5.95
Error Between	35	224.447	6.413	
Within All Subjects	38	56.970		
Tests	1	19.604	19.604	18.89
Groups X Tests (Pre & Post)	2	1.039	0.520	0.50
Error Within	35	36.327	1.038	
Total	75	357.709		

ANALYSIS OF VARIANCE FOR THE EXPERIMENTAL AND CONTROL GROUPS ON PRE- AND POSTTESTS OF THE CALIFORNIA ACHIEVEMENT TEST'S LANGUAGE SPELLING SUBDIVISION

Source	df	SS	MS	F
Between All Subjects	37	251.074		
Groups	2	79.004	39.502	8.04
Error Between	35	172.070	4.916	
Within All Subjects	38	38.625		
Tests	1	10.538	10.538	13.46
Groups X Tests (Pre & Post)	2	0.670	0.335	0.43
Error Within	35	27.417	0.783	
Total	75	289.699		

ANALYSIS OF VARIANCE FOR THE EXPERIMENTAL AND CONTROL GROUPS ON PRE- AND POSTTESTS OF THE CALIFORNIA ACHIEVEMENT TEST'S TOTAL LANGUAGE DIVISION

Source	df	SS	MS	F
Between All Subjects	37	229.057		
Groups	2	62.199	31.010	6.52
Error Between	35	166.858	4.767	
Within All Subjects	38	41.335		
Tests	1	15.121	15.121	20.52
Groups X Tests (Pre & Post)	2	0.428	0.214	0.29
Error Within	35	25.786	0.737	
Total	75	270.392		

ANALYSIS OF VARIANCE FOR THE EXPERIMENTAL AND CONTROL GROUPS ON PRE- AND POSTTESTS OF THE CALIFORNIA ACHIEVEMENT TEST'S TOTAL BATTERY

Source	df	SS	MS	F
Between All Subjects	37	174.418		
Groups	2	44.221	22.111	5.94
Error Between	35	130.197	3.720	
Within All Subjects	38	28.370		
Tests	1	11.529	11.529	24.69
Groups X Tests (Pre & Post)	2	0.486	0.243	0.52
Error Within	35	16.355	0.467	
Total	75	202.788		