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ABSTRACT

The use of operant techniques in the classroom, especially with slow learners, was investigated, and several types of reinforcement were compared. Subjects were 129 fourth graders enrolled in a middle school in a disadvantaged rural Florida community. The subjects were stratified by race, sex, and homeroom and were randomly assigned to one of five treatment conditions: control, random reward, individual reward, combined reward, or group reward. Five subtests of the Stanford Achievement Text Battery were administered before and after the 11-week experimental period. Data were analyzed using parametric statistics, and results demonstrated the feasability and power of group techniques for classroom use. Of the operant techniques studied, the group rewards appeared to provide the most influential control over classroom activity, and individual rewards actually impeded the maximum growth experienced under group conditions. A bibliography and tables of results are included. (MS)

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The research reported herein was performed pursuant to a grant with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

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Bureau of Research

Errata - Final Report - Project No. 9-0257

Page 13, paragraph 2, line 1 Also paragraph 4, line 1	<u>fourth</u> grade instead of forth grade
Page 13, paragraph 2, line 4	<u>quantity</u> instead of quality
Page 15, paragraph 1	Entire paragraph should precede final paragraph on page 14
Page 15, No. 2 Also No. 3	(Group II) should read (Group I).
Page 16, No. 5	(Group II) should read (Group I) and (Group I) should read (Group II
Page 16, Nos. 6, 7, and 8	(Group I) should read (Group II)
Page 22, Word Study Subtest Paragraph 1, lines 3,4,5, and 6	The sentence beginning, "Although analysis . . ." and ending ". . . four experimental conditions." should be eliminated.

FOREWORD

The program of research herein reported was supported by the Bureau of Research, U.S. Office of Education, Department of Health, Education, and Welfare, under Grant No. OEG-4-9-190257-0045-010, Project No. 9-0257 awarded through the College of Education, University of Florida. The study was directed by John F. Jacobs, with the cooperation of Myron A. Cunningham and William D. Wolking all, at that time, with the Department of Special Education, University of Florida.

Particular appreciation is due the research assistants who participated in the project: Edward Boddy, Richard Hire, Fern Weinstein, Andrea Coe and Barbara Osgood.

The investigators are also indebted to the students in the classes included in the study; to the fourth grade teachers, Mesdames Brazeal, Miller, McArthur, Rhodes and Stokes; to the Principal, Mrs. Amelia Erwin; Mrs. Joyce Bullock, Country Director of Instruction; and Mr. Lee Martin, Levy County School Superintendent.

Thanks are also due Dr. Richard H. Johnson, Chico State College, for his valuable ideas in the initial conceptualization of this project and his contribution to the literature review, and to Marnell L. Jacobs for her constructive support and criticisms of the preparation of the original proposal, the conduct of the study and the preparation of this final report.

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SUMMARY

PURPOSES: It was the purpose of this project to investigate the feasibility of using operant techniques in classrooms of normal class size, to develop techniques for working with slow learners, tc compare several nodes of reinforcement, and to establish the independence of teacher-student interaction in precision teaching. The project was designed to demonstrate the power of operant techniques independent of clinical, one-to-one relationships and to establish the validity of methodology through parametric statistical techniques. The project was also an attempt to contribute to the almost non-existent body of empirical literature dealing with the slow learner.

More specifically, this research compares the effect of individual versus group rewards on developing reading skills; the use of no reward, random, group, individual, and combined individual with group reward schedules; and the effect on growth of the novelty of reward, independent of contingencies and of the Hawthorne effect.

METHODS: All 129 fourth grade students enrolled at a middle school in a small, rural, economically deprived Florida community were used in the study. The population was stratified by race, sex, and home room and randomly assigned to one of five experimental conditions.

Five subtests of the Stanford Achievement Test Battery were administered before and after the 11 week experimental period. The Otis Lennon Mental Abilities Test (Mean IQ = 81.16, S.D. = 13.82) was used as an independent measure of randomization.

Teachers were randomly assigned, on a daily basis as a control for teaching skill and teacher-student interactions, to one of the five experimental conditions:

1. Control: This class worked for one hour daily with S.R.A. reading laboratories receiving only the assistance, guidance and praise used in a normal classroom setting.

2. Random Reward: Using identical materials, this group received at predetermined intervals the reward of released time. These rewards were contingent upon the dictates of a schedule prepared in advance and in no way related to classroom activities.

3. Individual Rewards: As each child completed an exercise he was rewarded with 3 minutes of released time to be deducted from the end of the class period.

4. Combined Reward: As in group 3, but additional released time was awarded when the entire class displayed on-task behavior for predetermined intervals.

5. Group Reward: This group received released time only when the entire class was working in an appropriate manner for a predetermined period of time.

RESULTS: It is felt that the present study, dealing with traditional academic measures, demonstrates both the feasibility and power of group techniques while exercising experimental control over most of the factors generally effecting internal validity. It is also expected that application of the methodologies described can be widely applied to other populations.

That operant techniques can be successfully applied to classrooms of normal class size would seem to be demonstrated when the mean gain scores of the students receiving rewards under the various group conditions (random, combined, and group reward) are compared with the control condition or the historic gains made by the population. The mean gain under the three groups reward conditions was more than twice the historic rate of gain or the gain under control conditions, with the group reward condition nearly three times the historic rate.

With regard to the comparison of the several modes of reinforcement, the analysis of mean gain scores would suggest that group contingencies exert the most powerful control over behavior in a classroom setting. It was hypothesized, prior to the study, that since individual rewards have been demonstrated to be effective in the change of behavior, and that group rewards could also effect changes, the combination of group and individual rewards would be mutually reinforcing and effect a more dramatic change than either technique used in isolation. However, the data suggest that group contingencies are approximately twice as powerful as individual contingencies and that individual operant conditioning actually serves to impede the maximum growth obtained under group reward conditions.

INTRODUCTION

It was the purpose of this project to investigate the feasibility of using operant techniques in classrooms of normal class size, to develop techniques for working with slow learners, to compare several modes of reinforcement, and to establish the independence of teacher-student interaction in precision teaching. The project was designed to demonstrate the power of operant techniques independent of clinical one-to-one relationships and to establish the validity of methodology through parametric statistical techniques. The project was also an attempt to contribute to the almost non-existent body of empirical literature dealing with the slow learner.

More specifically, this research compares the effect of individual versus group rewards on developing reading skills; the use of no reward, random, group, individual, and combined individual with group reward schedules; and the effect on growth of the novelty of reward, independent of contingencies and the Hawthorne effect.

The importance of experimenter-subject interaction has been traditionally overlooked in educational research design, particularly where studies involve a small number of classes. One exception has been Rosenthal's (1966) work dealing with experimental expectancy. The present research, through the use of a randomized equivalence of a teacher-student interaction, was designed to investigate the independence of operant techniques on experimenter-subject interaction.

The present project was further designed to provide familiarity with precision teaching techniques to area teachers, and training in techniques and methodology to a number of public school personnel expected to assume leadership roles in the near future.

REVIEW OF LITERATURE: Educators have been faced with the task of developing educational methodologies for classroom use which effectively utilize learning phenomena associated with mental retardation (Blackman, 1966). It is generally hoped that methodologies developed for the mentally retarded will be translatable for adaption into the regular classroom. Typical of such efforts has been the development of teaching machines (Blackman, 1964), reading methods (Jordon, 1963; Bernstein, 1963; and Della Piana, 1968), team teaching approaches (Taylor and Olsen, 1964), perceptual training (Chansky and Taylor, 1964), and teaching materials with high sensory stimulus value (Blue, 1963; Cruickshank, 1961; Zeaman and House, 1963).

Comparatively little research has been published dealing with programs which have placed retarded children in a specially engineered classroom learning environment giving direct attention to these children's motivational status and skills as learners. Even less research has been published dealing with the slow learner (Jacobs, et. al., 1967; Younie, 1968). It is logical to assume that no kind of

learning can take place unless the learner is able to pay attention, concentrate, and respond to appropriate stimuli. A child not attending to relevant cues cannot respond appropriately, hence learning, if it occurs at all, is accomplished in a less effective manner. Research suggests that attentional behavior is one of the important learning skills which frequently functions much less efficiently for the mentally retarded than for normal children (House and Zeaman, 1961; Heber, 1957; Gardner, 1958; Terdal, 1967). The engineering of attention is seen by Robinson and Robinson (1965) as one of the keys to successful training of the mentally retarded child, and by extension, to the slow learner. They suggest:

> "Non-retarded and retarded children both profit from teaching aids (and methods) which are employed in the classroom to rivet their attention on the essential elements of the lesson. For retarded children, however, management of attention is possibly the most valuable contribution the teacher can make." (p. 329)

It is, in part, with this particular problem of poor attentional behavior in the slow learner and its closely allied problem of motivation that this study is concerned.

BEHAVIOR MODIFICATION: A behavior modification view of teaching and managing attentional behavior, as suggested by Headrick (1963, p. 929), emphasizes that appropriate attentional responses may be taught through classroom procedures which consistently reinforce desired responses. This approach has been demonstrated with emotionally handicapped children with the remediation of similar behavioral and academic deficits. Where inattentiveness, distractibility, hyperactivity, etc., have presented major barriers to learning in a classroom setting, operant techniques have proven to be a valid approach in teaching and strengthening productive learning behavior (Quay, Werry, McQueen, and Sprague, 1966; Hewitt, 1966; Nolen, et. al., 1967).

Among the purposes of this study was the investigation of the effectiveness of operant conditioning techniques in classes for slow learners as a means of systematically teaching attentional task-oriented behavior and their effects upon reading. This general purpose may be expressed in the following questions:

1. Are classroom learning skills of slow learners amenable to a teaching methodology based on an operant behavioral analysis in classrooms of normal size?

2. What differences exist when using the general method of operant conditioning as applied in a classroom setting with slow learners between utilizing group and individual reinforcement contingencies?

3. Can improvement in learning be brought about by the use of operant techniques when applied to groups of normal class size?

The experimental analyses of behavior conducted by Skinner (1938) and subsequent researchers have provided many of the basic principles upon which current behavior modification techniques are based.

Typical of the rationale employed in the experimental approaches to individual and classroom applications of behavior modification principles, is that expressed by Quay (1966) and Bijou and Baer (1961, 1967). They view behavior disorders (overt behavior, academic response, social skills, etc.) both in diagnosis and remediation, primarily in terms of the external observable events of the problem itself. The purpose in treatment is the learning of productive behavior within the context of the child's problem under consideration.

Behavior in the child is seen as the end product of interaction (e.g., learning, of environmental experiences and pre-dispositional factors which may include heredity, states of the central nervous system, etc.). For the mentally retarded and the slow learner, these pre-dispositional factors may limit the ultimate complexity, type and rate of possible behaviors, ranging from moderate to extreme deviations from the normal: "Thus, the retarded child's structural make-up or his physiological functioning may be incomplete or damaged, similarly, his history of interactions with people and things may not have provided essential experiences or he may have learned behaviors which interfere with normal progressions in learning" (Bijou and Baer, 1967, p. 256).

Based on this functional approach to the analysis of behavior and other supporting experimental evidence, Martin and Powers (1967) have approached the problem of attentional behavior with mentally retarded children on the basis of this operant conditioning analysis:

> "Attention span refers to nothing more than the behavioral events to which the name is attached. These behavioral events are explained in terms of environmental variables in the presence of which behavior occurs. This interpretation places emphasis upon behavior that interferes with attending to a task, as well as the attending behavior itself. Thus, task perseverance, or a long attention span, is primarily a function of presenting reinforcements contingent upon attending behavior, and allowing incompatible behavior to go unreinforced. In addition, an operant analysis also stresses a concern for environmental variables that maintain behavior incompatible with long attention span." (1967, p. 567-568).

Operant conditioning consists of ways of changing the strength of the response using reinforcers as consequences of that response. The basic formulae of operant control consists of four kinds of

reinforcement procedures:

(1) Positive reinforcement, which strengthens the response;

(2) Removal of negative reinforcement, which strengthens the response;

(3) Negative reinforcement, which weakens the response;

(4) Removal of positive reinforcement, which weakens the response.

"These four reinforcement procedures completely define the basic ways in which an operant behavior may be controlled by reinforcement consequences and that all other procedures involved in reinforcement of operant responses are variations or combinations of these four." (Bijou and Baer, 1961, p. 38)

A reinforcing event is, by definition, any consequence or set of stimulus conditions which increase the probability of the behavior they follow.

The problem of teaching academic tool subjects to retarded children in a classroom setting was explored by Bijou, Birnbauer, Kidder and Pague (1967). The teaching of prerequisite academic behavior was considered to progress and whose reactions to previous educational experience range from apathy to outright rebellion. The experimental group, ranging from 8 to 14 years of age, had a mean mental age of 7 years and a mean IQ of 63. The task of teaching behavior that supported the learning process was considered to be two-fold:

(1) The strengthening of desirable attentional behavior, and

(2) The weakening and elimination of non-productive behavior that disrupted the learning process.

It was found in the initial attempts that providing verbal social reinforcement for correct academic responses and acceptable classroom behavior, while ignoring the undesirable behavior, produced little consequence. However, the pairing of social reinforcement with two token systems which gave tangible rewards did establish and maintain higher rates of study behavior and greater cooperation in the classroom. Effective control of disruptive behavior was established by pairing withdrawal of social approval with "time out" procedures.

The problem which Bijou (1967) encountered in a singular use of adult social reinforcement is also described by Johns and Quay (1962), Levin and Simmons (1962), and Bijou (1966), who indicated that adults, as models and social reinforcers with the more natural (natural to the

traditional school setting) reinforcers of social approval, behavior can be brought under stimulus control. Once this occurs, elimination of the less natural tangible reinforcement may be accomplished by a gradual fading of its presentation as a reinforcer. Bandura and Walters' (1963) study also demonstrated that it is more efficient to counter-condition maladapted behavior or, in effect, replace it simultaneously with incompatible adapted behavior than merely try to extinguish it without replacement.

One of the more crucial problems in classroom situations is the finding of methods which will facilitate the emission from the child of those adaptive behaviors which can be immediately rewarded and thus rendered more probable. Although reinforcement contingencies dispensed by the teacher have been demonstrated to be critical, the use of the peer group in this respect would also seem to be of equal importance. Bijou's (1967) utilization and direct control of the peer group influence was essentially through the use of negative reinforcement, removal of positive reinforcement, and through the use of modeling or imitation.

Patterson and Anderson (1964) found the peer group a potent factor in maintaining or modifying aggressive behavior in children. Reinforcing contingencies of the group determined the relative frequency of occurrences of various aggressive responses most likely to be punished by the peer group seemed to occur with the lowest frequency.

In an application of operant conditioning techniques to the control of a hyperactive child in a special class setting, Patterson (1965), devised a situation to reduce the disruptive behavior. For every 10 seconds of appropriate behavior the child received one point. At the end of each session, these points were converted to pennies and candies which were shared with classmates. This use of peers who depended on the child to get the reinforcement increased the pressure of the group.

Patterson, Jones, Whittier, and Wright (1965) believe that the significance of any change in behavior lies in the effect it produces in the reactions of the social culture. They have suggested that future programs designed to remediate behavioral defects should be based upon a hierarchy of responses which would place the child in a position to be rewarded or punished by the social culture for acceptable or maladaptive behaviors.

The provisions of such a social culture was one of the major purposes of a study conducted by Hotchkill (1966), who departed from the usual approach of dealing with the specific behavior of individuals in the classroom group. Using emotionally disturbed children of elementary school age, he demonstrated the feasibility of applying operant techniques to a whole class on a group basis. During the experimental period of 22 days, the reinforcing system supporting desirable

work-study behavior demonstrated two distinct procedures: (1) First, the application of a reinforcing event for attentional behavior contingent upon the performance of all the class members based on a specific but gradually increasing time basis, and (2) the application of social reinforcement in the form of verbal approval for appropriate behavior, while ignoring all inattention and undesirable classroom behavior. The research findings indicate a significant reduction in pupil activities which did not support the classroom teaching-learning process. This more appropriate behavior, in turn, generalized to outside of classroom activities. Academic achievement, as judged by the teacher, also improved. Hotchkill summarized:

> "The Lott and Lott (1960) study suggested that if the pupils in a class experienced success and social approval in the presence of other pupils, positive feelings toward the other class members would increase and negative or aversive attitudes would decrease. Their study also suggested that if a situation could be created where the students worked together successfully and all were rewarded, a group 'cohesiveness' or 'espirit de corps' would develop. This experiment required all boys to cooperate and work together in order to win or earn money and that situation quickly resulted in disapproval of any maladaptive behavior and mutual approval for good behavior. Counter-conditioning, response substitution in effect, took place as a child learned new ways to be rewarded in place of no longer effective, and unrewarded, maladaptive ways." (1966, p. 149)

Quay (1966) approached this group technique by attempting to specifically train attending behavior of 5 children in a small class setting. A specially designed box containing a light under the control of the experimenter was placed on each child's desk. On the basis of paying attention to the teacher, the light would go on from time to time. Technically, the reinforcement of the attending behavior was on a fixed ratio of 1:5. Each flash of light was worth one piece of candy. During the 52 day period of this training the method was judged to have some positive effects. No mention was made of the use of negative reinforcement. In this study it would appear that the ratio of reinforcement provided a very unrewarding or slow start for some of the children. In addition, the peer group was not utilized except as it slowly improved and provided a model for appropriate behavior.

Nolen, Kunzleman, and Haring (1967) also have investigated the extension of operant conditioning techniques to classroom learning in an experimental class setting. The reinforcing system was built around the operant behavior of each student's specific skills in academic tasks.

> "By standards of skill specifics, then, the frequency of accurate academic responses is of primary concern. Deficiencies the child may have in content or extent and/or rate of learning within any

one of a number of specific academic or social behavioral skill areas...it is considered fundamental to the application of behavioral management techniques in the unit's classrooms." (p. 164)

This study departs from previous work and other on-going research in that it does not treat readiness for learning behavior initially. The reinforcing contingencies are made to support a multiplicity of educational and social factors critical to an accurate educational resonse.

Hall, Lund, and Jackson (1968) investigated the effects of contingent teacher attention to study behavior of one first grade and five third grade children in a regular classroom setting who had high rates of "disruptive and dawdling" behavior. The use of only teacher attention as reinforcement for appropriate study behavior paired with the ignoring of non-study behavior resulted in a sharp increase in study rates of the experimental subjects. In a classroom setting where a peer group model of appropriate behavior already existed, social reinforcement was effective with the small minority of students who were exhibiting acting-out, disruptive behavior.

Sulzbacher and Houser (1968) report a study using group-contingent punishment in a successful attempt to reduce the frequency of undesirable disruptive behavior in a class of fourteen mentally retarded children. The forfeiture of a portion of specially scheduled free time was the punishment used.

In the most recent published report of group-contingent behavior modification techniques, Schmidt and Ulrich (1969) report on three studies dealing with classroom noise and out of seat behavior. A single class of 29 fourth-grade elementary students received two minutes of additional gym time after maintenance of a ten-minute quiet period. Noise level was monitored by a sound-level meter, and excessive noise was defined as noise exceeding 42 decibels. These studies demonstrated the effectiveness of group operant techniques in accomplishing the desired objectives.

The majority of the research appears to have dealt primarily with classes of emotionally disturbed children falling within the normal range of intelligence with some recent attention to the mentally retarded. Published research on the use of operant techniques with the educable mentally retarded in a special class setting seems to be limited, and research with this technique dealing with slow learners is non-existent. Group studies appear to a limited extent within the literature, but are in large measure confined to small groups of five or six children. The development and demonstration of viable techniques which can be implemented by regular classroom teachers in classes of standard size has not been attempted.

SLOW LEARNERS: The retarded have received increasing attention over the past hundred years or so. Johnson points out that:

> "The children who are included in the lowest quartile intellectually, of the population are steadily demanding more attention from psychologists, educators and various social agencies. No matter what the problem being examined, whether it is learning, adjustment, or social behavior, this portion of the population is sure to be involved as a factor to be evaluated (1963, p. 3-4).

This lowest quartile of the population is generally thought of in three categories: The mentally deficient or severely retarded, who represent approximately 0.5 percent of the total population; the mentally handicapped, who represent 3 to 4 percent of the total population; and the slow learners who, according to Johnson (1963) represent 15 to 18 percent of the total population, while Jacobs, et. al. find as many as 23 percent in this category.

Surprisingly, it is this latter group which has received the least study.

> "In every school system there exists a group of pupils who, being neither average nor mentally retarded, have been largely overlooked in most educational thinking and planning...Most educators have long been aware of this 'problem' group or 'grey' area in their school system, but have made little effort towards adequate provisions for them" (Chidley, 1963).

Indorf (1963) defines slow learners as those whose rate of learning falls behind class standards to the extent that adjusted teaching procedures are necessary. He cites major causes as: Limited mental ability, mental illness, transitory mental trauma, or reading disability. Indorf stresses the basic academic needs of slow learners as including reading and arithmetic skills.

The following definition of slow learners was developed by the U.S. Office of Education (1967):

> "Slow Learners - Pupils who display evidence of having difficulty in adjusting to the usual curriculum in academic areas, requiring some minor modifications of school offerings within the regular classroom in order to attain maximum growth and development; in terms of intelligence quotient (IQ), those individuals whose IQ falls within the general range of 75 or 80 to about 90.

A wealth of literature exists dealing with slow learners. The vast majority of this literature is, however, primarily theoretical or of a general curricular nature.

In a survey of 238 studies dealing with reading (Gutts, 1963), general intelligence was found to correlate highly with reading achievement. While discussing the needs and problems faced by slow learners at the secondary school level, Early (1963) emphasizes the importance of early identification and remediation of reading problems among the slow learners. He points out that this is rarely done, and that the secondary schools are faced with the problem of functional non-readers.

In discussing specific problems presented by the possession of inadequate reading skills for dealing with social studies and other content subjects, Fay (1963) emphasizes four basic areas for development: (1) Vocabulary; (2) thought-structure (the organization of ideas from isolated facts); (3) work-study skills and the use of dictionaries and encyclopedias and other sources of basic information, (4) comprehension and interpretation of material.

Although Johnson writes that there is no evidence from research (1963, p. 47) that the slow learners as a group have any specific emotional and behavioral characteristics, he goes on to say that "The slow learners present many emotional and behavioral problems." (p. 54) He maintains that "it is common to find many more discipline problems among the slow learners than among the children comprising the rest of the general school population." He also points out that although "Some slow learners withdraw from the group, most become aggressive to compensate for their inability to participate." According to Johnson, the slow learner also "tends to select as friends others who are having similar problems and displaying similar behavior."

Edwards (1961) states that the slow learner enunciates slowly and is poor in spelling. Oral expression is very limited (Boutwell, 1965) and vocabularies are smaller, with few having normal language development (Alexander, 1966). Featherstone (1951) states that the slow learner is more often "lazy" or "inattentive." Both Featherstone (1951) and Shawn (1964) report the performance of the slow learner as lower in defining, distinguishing, analyzing, and reasoning. Shawn also reports that the slow learner is "hand-minded" rather than academic and his experience is limited, warped, or both.

Brunda (1961) says the slow learner is essentially normal in emotional development. Johnson (1963) and Chidley (1963) both feel that the school situation is frustrating to the slow learner, and that this may well initiate many of the behavioral problems in the classroom that Liddle (1959) reports, such as school failure, dropout, discipline problems, and delinquency.

> "A considerable proportion of pupils are incapable of the satisfactory performance commensurate with their ages. The children experience failure, frustration, and humiliation. They can see that, no matter how much effort they expend, they cannot do the things that their classmates do with

relative ease. They do not know why this is so. All they know is that they get deficiency marks, are not promoted, find themselves together with younger children, are criticized at home for their report cards, and are addressed as 'lazy' or 'dumb.' The only satisfactions left to them are those again which do not earn social acceptance, such as daydreaming, truancy, 'mischievous' behavior and compensatory resource to physical strength through fighting." (Kanner, 1962)

In one recent empirical study dealing with problems of the slow learner (Jacobs, et. al., 1967) slow learners were found to present problems in the following areas significantly more often than normal children: (1) Emotional problems; (2) social immaturity; (3) adjustment needed in materials and methods; (4) lack of interest, initiative, and motivation; (5) high absenteeism; (6) attention-seeking behavior; (7) lack of rapport with the teacher; (8) poor written and spoken language; (9) teacher time required; (10) peer relations; (11) dislike school; (12) poor adjustment and ability to abstract and generalize; (13) discipline; (14) general health; and especially (15) academic achievement and (16) reading.

Despite, or perhaps in part because of, the problems associated with providing for the slow learner, a recent survey of educational agencies in the United States and Canada (Jacobs, 1968) reveals there are no existing, on-going programs specifically designed to serve these children.

METHODS

Five regular classrooms, as similar as possible, in the Williston Middle School, Williston, Florida were used for the experimental portion of this project. Office space was provided within the offices of the College of Education, University of Florida, Gainesville, Florida.

All forth grade students regularly enrolled at the Williston Middle School participated in the project. Science Research Associates Reading Laboratories, at appropriate grade levels, were available in sufficient quality for each student to work at his own level at his own speed.

The population was stratified according to homeroom, sex, and race, and randomly assigned to one of the five experimental conditions. Intelligence, as measured by the Otis Lennon Mental Abilities Test, was used as a control for random assignment. (See discussion in Chapter V.) Approximately one hundred thirty children participated in the study, with between 20 and 30 in each experimental group.

The five regular forth grade teachers at Williston Middle School and five University of Florida graduate students served as teachers and tokeneers during the study. Each of the ten teachers involved served, on a randomized schedule, as both teacher and tokeneer to the various experimental groups. The intent being to control for teacher-class interaction that might affect internal validity of the study. Schedules for assignment as teacher or tokeneer were prepared each two weeks by randomly assigning one teacher as either teacher or tokeneer to each classroom for a given day. Successive daily assignments were similarly made for the entire two week period.

The Stanford Achievement test battery (word meaning, paragraph meaning, spelling, word study and language subtests) was administered to each of the subjects in the study at the beginning and end of the experimental period. Pretesting was conducted during the first week of school. Posttesting occured during the last week of school prior to the Christmas holiday, allowing approximately 11 weeks (55 days) of actual classroom work. All tests were machine scored by the publisher. Gain scores on each part were used as the dependent variable in all analyses. Pre- and post-test scores are given in the Appendix.

Since both pre- and post-administrations of the Stanford Achievement test battery extended over a two day period, all subjects were not present for all four days of testing. No attempt was made to offer make-up testing sessions and only those subtests for which both a pre- and post-score were available were considered in the analyses. Although all five experimental conditions had equal ns, the analyses reflect unequal ns on the various subtests as a result of absenteeism.

Experimental Conditions:

Group I: Control: This group received assistance, guidance and

support, from the teacher assigned for each particular day, in the preparation and completion of their assignments as outlined in the teachers' manual accompanying the S.R.A. materials. The students maintained their own pace and received encouragement as do regular students in normal school programs. The tokeneer assigned to this group for a particular day was present and kept appropriate records, but did not enter actively into class participation. Children were expected to read and answer questions relating to S.R.A. Power Builders at appropriate levels of difficulty. For the first three weeks of the study a score of 80% correct was required before a new Power Builder could be begun. Beginning with the fourth week a 100% score on the individual assignment was necessary before beginning a new assignment.

Upon successfully completing five assignments at a given color level, (level of difficulty), a child's teacher of a given day could, at her discretion, andvance the child to the next level of reading material. Similarly, if a teacher felt a child was working with material that was inappropriately difficult, the level of difficulty (color) could be changed to one considered to be more suitable.

Group II: Random Reward Group:

This group was treated exactly as Group I, with the following exception: At random intervals, contingent upon the dictates of an advance schedule, the group was given, as a group, a reward or accelerator (released time) in amounts equal to, in aggregate, the amount of released time received by Group IV on the preceding day.

Group III: Individual Reward Group:

This group received the same program as Group I, with the following exception: Upon completion of successively more difficult assignments, individual students were rewarded with released time. This released time was deducted from the daily academic program. As with Group II, children were allowed, at their discretion, to partake in the planned recreation program, or without disturbing other members of their class, use their time as they chose.

Group V: Group Reward:

The same academic program was followed as in Groups I, II, and III. Group IV, however, received rewards contingent upon the entire group having displayed attending behavior. Attending behavior being defined as every child in the group working with the study materials in the prescibed manner. (This would include exchange of materials, conferences with the teacher, record keeping, and such other activities as were directly related to the program.) Timing began anew, without a reward being given, every time any child in the group was not attending or was disruptive in any way. Timing and the awarding of group awards was, as with the other groups, handled by the tokeneer.

Group IV: Combined Individual and Group Reward:

Again, the same academic program was followed. Rewards in this group were awarded both for group attending, as in Group V, and for individual success as in Group III.

Records of group attending (and the awarding of group reward) were kept, in all cases, by the tokeneer. Individual progress was recorded by the students as provided for by the S.R.A. program, and individual rewards were made by the tokeneer.

Individual rewards were administered by means of individual cards upon which was written the time at which the student could be excused to participate in the recreation program. Each card was marked, as rewards were awarded, for a progressively earlier dismissal time. (e.g., the first award a child received was for 2:57. Upon completion of the next scheduled amount of work of the appropriate level entitling him to a further reward, he would have his card marked for dismissal at 2:54, etc.)

Each classroom was equipped with an easily visible clock with hands exposed. Group rewards were administered by the advancement of the minute hand of the clock by the tokeneer. The experimental portion of the study began daily at 2:00 and continued through normal dismissal time of 3:15.

The subjects spent their entire day with their regular homeroom classmates. At two o'clock each day, the children were reorganized into the experimental grouping used for the study. Pre- and post-testing was done while children were in their homeroom grouping.

Null Hypotheses:

In an attempt to establish statistically ($p \leq .05$)significant differences between the above descibed samples, the following null hypotheses were tested:

1. There is no significant difference between Groups I, II, III, IV, and V.

Further: There is no significant difference between

2. Normal teaching practices (Group II) and the awarding of Individual Rewards contingent upon success (Group III).

3. Normal teaching practices (Group II) and Group Rewards (Group V).

4. Normal teaching practice (Group I) and the combined effect of individual rewards and group rewards (Group IV).

In an attempt to determine the effects of reward not contingent upon success, and as a control for the novelty of rewards in the experimental setting,

5. There is no significant difference between the awarding of random rewards (Group I) and normal teaching practices (Group II),

6. There is no significant difference between the awarding of random rewards (Group I) and individual rewards (Group III),

7. There is no significant difference between the awarding of random rewards (Group I) and group rewards (Group V),

8. There is no significant difference between the awarding of random rewards (Group I) and the combined effects of individual rewards and group rewards (Group IV).

In a further attempt to establish the relative value of Individual Rewards, Group Rewards, and the combination thereof:

9. There is no significant difference between Groups III, IV and V; More specifically, there is no significant difference between:

10. Individual rewards (Group III) and Group Rewards (Group V).

11. Individual rewards (Group III) and the addition thereto of Group rewards (Group IV).

12. Group rewards (Group IV) with the addition of individual rewards (Group III).

RESULTS

DESCRIPTION OF POPULATION

The population consisted of all one hundred twenty-nine fourth grade students attending the Williston Middle School located in Williston, Florida. This is a small, rural, economically deprived community in North Central Florida. The school was organized as a middle school during the summer preceding the present study and was physically occupying what had been the Negro Vocational School. Grades four, five, six, seven, and eight were housed in the school plant. A large percentage of the children were transported to school daily. Approximately 40% of the children were black and 60% were white.

TABLE I: Mean I.Q. of experimental groups.

GROUP	N	MEAN I.Q.	S.D.
Random Reward	22	79.91	12.81
Control	23	82.65	9.97
Combined Reward	24	80.24	15.06
Individual Reward	24	81.00	15.64
Group Reward	20	82.15	15.68

The mean I.Q. for the population studied, as calculated from the school records, was 81.16 (S.D. = 13.82), as measured by the Otis Lennon Mental Abilities Test. As described earlier, the population was stratified by homeroom, sex, and race and then randomly assigned to one of the five experimental conditions. I.Q. scores were then used as a measure of the random assignation. Mean I.Q.'s for the five groups are presented in Table I and the analysis of variance in Table II.

TABLE II: Analysis of variance: Otis Lennon I.Q. Scores.

SOURCE	SS	DF	MEAN SQUARE	F RATIO
Between Groups	127.06	4	31.77	0.1613
Within Groups	21862.12	111	196.96	
Total	21989.18	115		

The difference in mean I.Q. between the control group, which had the highest mean I.Q., and the random reward group, with the lowest mean I.Q., was only 2.7. The low F ratio (F = 0.1613) would tend to confirm that assignation was random and the five groups were equivalent at the beginning of the study.

Mean Gain Score

The major analyses in the study consisted of the use of analysis of variance and individual t tests carried out on the mean gain scores over five subtests of the Stanford Achievement Test. Individual subtest analyses were also considered and are discussed separately.

Grade equivalency gain scores in each subtest area of the Stanford Achievement Test which were considered (language, word study, spelling, paragraph meaning and word meaning) were calculated by subtracting pretest scores from posttest scores. If a subject missed either the pre- or posttesting for one or more subtests, those subtests gain scores were not calculated. Mean gain score was then calculated by summing subtest gain scores and calculating the mean gain for each subject. These mean gain scores were then subjected to an analysis of variance. The data is presented below.

TABLE III: Grade Equivalence Mean Gain Scores: Means and Standard Deviation

Treatment Group	Random Reward	Control	Individual Reward	Combined Reward	Group Reward
Sample Size	24	24	23	27	22
Mean Gain	0.3343	0.2038	0.2336	0.4014	0.4800
S. D.	0.4602	0.3155	0.3123	0.4225	0.3719

TABLE IV: Analysis of Variance; Mean Gain Scores

Source	SS	df	ms	F
Total	18.2185	119		
Between Groups	1.3250	4	0.3312	2.2543
Within Groups	16.8934	115	0.1469	

Using the analysis of variance presented in Table IV and t-test for differences among the means to test the several null hypotheses, (with a critical difference for significance at the .05 level equal to 0.2178) the following inferences can be drawn.

A. There was no significant difference between normal teaching practice (Group II mean = 0.2038) and the use of individual rewards (Group III mean = 0.2336) in the large class classroom setting.

B. There is a significant difference ($p < .05$) between normal teaching practices (Group II = 0.2038) and the use of group rewards (Group V mean = 0.4800) with mean gain under conditions of group reinforcement more than twice as great as under normal teaching conditions.

C. The difference between normal teaching practice and the use of combined individual and group rewards approaches but fails to achieve significance ($p. < .10$).

D. Although the random introduction of a reward achieved a greater increase in mean gain scores than either normal teaching practice or the use of individual rewards and less gain than either group rewards or combined individual and group rewards, none of the differences were significant.

E. The mean gain score when using group rewards (Group V mean = 0.4800) was significantly ($p. < .05$) higher than when using individual rewards (Group III mean = 0.2336); the mean gain score under group reinforcement conditions again being more than twice that under individual reward conditions.

F. The use of a combined individual and group reward resulted in a mean gain score intermediate between the use of individual reward and the use of a group reward, though not significantly different from either.

These differences are perhaps more clearly understood when the gain scores are translated to their equivalent academic years of growth per year of school, as corrected for the actual duration of the study. The historic rate of growth is included for comparison and the data is presented in Table V.

TABLE V: Grade Equivalence Mean Gain Scores: As corrected to reflect years of academic growth per year of school.

Condition	Academic Growth Per Year of School
Students' Historic Rate	.69
Control Condition (No Reward)	.81
Individual Reward	.93
Random Reward	1.34
Combined Reward	1.61
Group Reward	1.92

The students' historic rate was determined by using the mean of the 5 subtest scores, and dividing by the 3 years the subjects had been in school prior to this project. It would appear the subjects involved had been achieving at a rate of approximately .69 years of academic growth per year in school. With a mean IQ for this population of 81 this would seem to be a reasonable and expected rate of growth.

The individual subtest analyses are presented below:

Language Subtest

On the Language subtest of the Stanford Achievement test, the greatest difference in gain scores between methods became apparent. Table VI presents the mean and standard deviations of the gain scores on this subtest and Table VII presents the analysis of variance.

TABLE VI: Language Subtest Gain Scores; Raw Score Gains

Group	N	Mean	S. D.
Random Reward	24	2.63	14.9
Control	23	3.00	9.3
Individual Reward	23	5.91	12.5
Combined Reward	26	9.69	11.1
Group Reward	20	12.25	10.0

On this subtest, mean gain scores for both combined reward and group reward conditions significantly ($p < .05$) exceeded the use of a random reward. Similarly the gain scores achieved by the control, or normal teaching practice group, were exceeded by both the combined and group reward conditions.

TABLE VII: Analysis of Variance: Language Subtest Gain Scores

	Sum of Squares	DF	Mean Square	D	P
Total	17043.9414	115			
Between Groups	1575.2178	4	393.80	2.83	<.05
Within Groups	15468.7366	111	139.36		

The use of the group reinforcement condition, where the reward was contingent upon the entire group maintaining "on task behavior," also resulted in a significantly greater mean gain in language than the use of individual rewards, where individual subjects are rewarded for their individual performance, as in traditional operant conditioning.

Again, these differences are perhaps more dramatically illustrated in Table VIII where gain scores are translated to academic years of growth per year of school.

TABLE VIII: Translated gain scores comparing rates of growth for subjects historically and under the five experimental conditions.

Condition	Grade Levels Per Year in School
Students' Historic Rate	.59
Control Group	.54
Random Reward	.67
Individual Reward	.99
Combined Reward	1.66
Group Reward	2.38

Word Study Subtest

There was no significant difference in gain scores on the word study subtest portion of the Stanford Achievement test. Mean gain scores, with standard deviations. are presented in Table IX. Although analysis of variance did not indicate significant differences, raw score gains under group reward conditions, were again much greater than under the other four experimental conditions.

TABLE IX: Word Study Skills Gain Scores; Raw Score

Group	N	Mean Gain	S. D.
Control	24	1.83	7.09
Individual Reward	22	2.14	7.47
Group Reward	20	2.35	6.55
Random Reward	24	2.88	6.85
Combined Reward	24	4.71	6.97

Spelling Subtest

There were no significant differences in gain scores on the spelling subtest of the Standford Achievement Test. Mean gain scores, with standard deviation are presented in Table X.

TABLE X: Mean Gain Scores; Spelling

Group	N	Mean Gain	S. D.
Random Reward	24	2.79	4.9
Control	24	3.04	4.7
Individual Reward	21	3.19	5.2
Group Reward	20	5.25	5.8
Combined Reward	25	5.32	7.6

Again, as with the word study subtest, the differences failed to achieve significance, but the group reward and the combined group and individual reward conditions were greater than under the other three conditions.

Paragraph Meaning

Grade equivalence gain scores in the paragraph meaning subtest for the five experimental conditions are presented in Table XI.

TABLE XI: Paragraph Meaning Grade Equivalence Gain Scores

Group	N	Mean Gain	S. D.
Random Reward	22	.11	.77
Control	22	.17	.89
Individual Reward	23	.37	.71
Group Reward	23	.26	.65
Combined Reward	20	.26	.75

Gain scores in paragraph meaning, when subjected to analysis of variance, were not significantly different, nor were the significant differences when individual t tests were calculated. However, the individual reward condition was highest, followed by group reward and combined reward conditions, all of which equalled or exceeded a growth rate of one academic year per year in school. The random reward condition equalled the historic rate of growth for 4th graders in the study, whereas the control condition fell well below even the low historic rate of gain.

Word Meaning

When the gain scores in the word meaning subtest were considered using analysis of variance, the resultant F was 1.88, which is not significant at the .10 level.

However, when individual experimental groups were compared (using the two-tailed t test, $p < .05$), two of the differences proved to be significant: Group reward gains were significantly greater than gains in either the control condition or in individual reward conditions. The use of a random reward again demonstrated surprising gains and just failed to show significance over the control condition. Grade equivalence gain scores for the five conditions are given in Table XII.

TABLE XII: Grade Equivalence Gain Scores: Word Meaning

Group	N	Mean Gain	S. D.
Control	22	.18	.89
Individual Reward	24	.37	.68
Combined Reward	23	.40	.50
Random Reward	21	.58	.78
Group Reward	20	.71	.65

These differences are perhaps again more clearly understood when the gain scores are translated to their equivalent academic years of growth per year of school as corrected for the actual duration of the study. The historic rate of growth is included for comparison and the data is presented in Table XIII.

TABLE XIII: Word Meaning Grade Equivalence Mean Gain Score; As corrected to reflect years of academic growth per year of school

Condition	Academic Growth Per Year of School
Students' Historic	.73
Control Condition	.72
Individual Reward	1.48
Random Reward	2.32
Combined Reward	1.60
Group Reward	2.84

SUBJECTIVE RESULTS: Although no attempts were made to measure such factors as discipline, absenteeism, or classroom noise level, differences were noted and discussed by the participating teachers, visitors, and project director.

The group which appeared consistently to present the greatest difficulty to the teacher in the area of classroom management was the control group, the program most like a normal school program. Although

during the initial few days of the project this group presented very few difficulties (which may be attributable to the novelty of the experimental rotation of teachers), classroom management difficulties reemerged within the first few weeks to a level not unlike that experienced in the balance of the school.

Similar problems developed late in the experimental period in the random reward group. Although the random reward group showed a relatively high level of achievement when gain scores were considered, it was felt by the experimenters that the greatest percentage of this gain occurred prior to the last two or three weeks of the project. It was during these last two weeks of the project that classroom management presented difficulties in working with this group. Although exact analyses were impossible, the behavior within the random reward condition could be compared with "superstitious behavior" as generated in experimental laboratories, with the manifest behavior not having been elicited or shaped by the experimenters.

The classroom behavior of the members of the individual reward condition, although presenting an appearance of an environment for learning superior to either the random or control conditions and superior to other classes within the school, did not equal the desirable characteristics achieved by the group reward or combined reward groups. Agreement on subjective differentiation of classroom atmosphere between the group reward and combined reward conditions could not be achieved; however, it was felt both these groups provided an educationally sounder atmosphere than any of the other experimental groups.

CONCLUSIONS

That operant techniques can accomplish desired changes in a behavior has been repeatedly demonstrated under laboratory and free field conditions. The application of operant techniques to individuals in small groups (particularly in special education classes) is gaining acceptance among many educators. There has been, however, a reluctance on the part of teachers to apply these techniques in regular classroom situations. Teachers have generally admitted that operant techniques work in one-to-one situations but have felt that with 20 to 30 children in their classes, the methodologies of precision teaching were not feasible.

One or two earlier studies, dealing primarily with classroom management, have reported some success in the application of these techniques to regular classroom size groups. These studies were, however, time series, single group studies (in the classical operant paradigm) with almost no controls for internal or external validity.

It is felt that the present study, dealing with traditional academic measures, demonstrates both the feasibility and power of group techniques while exercising experimental control over most of the factors generally affecting internal validity. It is also expected that application of the methodologies described can be widely applied to other populations.

That operant techniques can be successfully applied to classrooms of normal class size would seem to be demonstrated when the mean gain scores of the students receiving rewards under the various group conditions (random, combined, and group reward) are compared with the control condition or the historic gains made by the population. The mean gain under the three groups reward conditions was more than twice the historic rate of gain or the gain under control conditions, with the group reward condition nearly three times the historic rate.

That operant techniques can be applied under non-experimental conditions would seem also to be supported by the continued use of the technique by the teachers after the conclusion of the study.

With regard to the comparison of the several modes of reinforcement, the analysis of mean gain scores would suggest that group contingencies exert the most powerful control over behavior in a classroom setting. It was hypothesized, prior to the study, that since individual rewards have been demonstrated to be effective in the change of behavior, and that group rewards could also effect changes, the combination of group and individual rewards would be mutually reinforcing and effect a more dramatic change than either technique used in isolation. However, the data suggest that group contingencies are approximately twice as powerful as individual contingencies and that individual operant actually serves to impede the maximum growth obtained under

group reward conditions.

In a separate project, currently in progress, the use of group contingencies is similarly proving far more efficacious than individual operant in modifying the social-interaction behavior of some autistic children in a child psychiatric ward at the University of Florida Medical Center.

Traditionally, research in the application of operant methodologies (with human subjects) has been conducted by investigators with a firm conviction in its efficacy. In studies using minimal controls (using a subject as his own control with a single experimenter), the skill level, expectancies, and the interactions of the experimenter become difficult to assess. In the present study, an attempt at equalizing skill level of the teachers was made through random daily assignment of the teachers. Individual day to day interactions of teachers with class or method could not be controlled or assessed. However, with skill level of teacher held constant across groups, the dramatic effects of individual operant seem to disappear; resulting in only slight improvement over standard classroom teaching practice.

Differences in accumulated released-time existed among individuals and groups, and the subjects in the four experimental conditions spent from ten to twenty percent less time in the classroom than did the control group. Despite the reduced amount of time spent studying, all four experimental conditions exceeded the mean gain of the control conditions. This would seem to suggest that almost any systematic schedule of immediate systematic reward would improve standard classroom methodologies. The use of random reward, although apparently effective over a short period of time, cannot be recommended due to the apparent development of superstitious-like behavior on the part of the class leading to classroom management difficulties.

Although the mean I.Q. of the population studied was within the slow-learner range, an examination of the gain scores of those children with average or above average I.Q.'s suggests no apparent differences from the slow learners in their reaction to the experimental condition.

Reading, as a subject matter area on which to focus the present research, was chosen because of the ready availability of materials and measures to suit the experimental design. Replication in other curricular areas seems to be indicated. Further, an investigation of the relative value of different parameters of reinforcement is also indicated.

That the relatively unrefined application of group contingencies can effect desired changes in regular classroom situations (changes in academic achievement rate as well as classroom management) has been demonstrated. That the level of skill required for the application of these unrefined techniques can be acquired by regular classroom teachers with only minimal instruction and supervision has also been demonstrated.

What remains is the replication, refinement and wide dissemination of the methods described in the present study.

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Appendix

Pre and Post Raw Score
and Grade Equivalence
Scores on All Subtests

GROUP I: RANDOM REWARD

No.	AGE Yrs.	Mos.	IQ	WORD MEANING Pretest Gr. Eq.	Pretest Raw Sc.	Posttest Gr. Eq.	Posttest Raw Sc.	PARAGRAPH MEANING Pretest Gr. Eq.	Pretest Raw Sc.	Posttest Gr. Eq.	Posttest Raw Sc.	SPELLING Pretest Gr. Eq.	Pretest Raw Sc.	Posttest Gr. Eq.	Posttest Raw Sc.	WORD STUDY Pretest Gr. Eq.	Pretest Raw Sc.	Posttest Gr. Eq.	Posttest Raw Sc.	LANGUAGE Pretest Gr. Eq.	Pretest Raw Sc.	Posttest Gr. Eq.	Posttest Raw Sc.
101	8	10	85	2.5	4	3.2	10	2.3	10	3.1	19	3.5	17	3.1	13	2.0	13	3.4	31	2.6	48	2.7	50
102	8	9	72	3.1	9	2.9	7	2.9	17	3.0	18	3.5	18	3.3	15	2.6	22	2.3	18	2.6	48	2.5	45
103	10	4	66	2.0	1	3.0	8	2.4	11	2.8	16	2.8	10	2.4	6	2.1	15	2.6	22	2.6	48	2.5	43
104				2.9	7	6.1	27	2.8	16	4.3	29	3.0	12	4.0	23	3.9	34	5.3	43	3.1	59	3.8	69
105	8	11	65	2.9	7	2.9	7	2.8	15	2.7	14	3.1	13	2.6	8	2.4	20	2.2	16	2.6	47	2.6	48
106	10	1	50	2.5	4	3.3	11	2.2	8	2.8	15	2.9	11	3.6	19	2.4	20	2.4	19	2.7	49	2.7	80
107	10	9	54	3.0	8	3.5	12	2.7	14	2.8	15	2.9	11	3.1	13	2.4	19	2.2	16	2.3	39	2.7	50
108	8	9	91	2.9	7	2.6	5	2.8	15	3.2	20	2.8	10	3.1	13	1.7	9	2.1	15	2.6	47	2.7	49
109						3.6	13			3.2	20			3.9	22			2.3	18				
110	8	9	97	2.7	6	3.0	8	2.9	17	3.4	21	2.2	4	2.6	8	2.2	17	2.4	19	2.3	40	2.8	53
111	8	9	89	3.2	10	3.2	10	2.4	11	2.3	10	2.6	8	2.4	6	2.0	14	2.3	18	1.5	21	1.4	18
112	9	1	79	3.2	10			3.0	18			2.2	4	2.7	9	2.5	21	2.2	16	2.6	47	2.8	52
113				2.6	5	3.2	10	2.6	13	2.9	17	3.0	12	3.2	14	1.8	11	2.0	14	2.1	36	2.5	44
114	9	2	95	3.1	9	3.6	13	3.7	23	3.0	18	2.5	7	3.5	17	2.4	20	2.4	20	3.1	59	2.8	55
115	11	10	64	3.1	9	3.2	10	3.1	19	2.6	13	2.7	9	3.4	16	2.2	17	2.4	19	2.1	35	1.2	14
116	9	1	74	3.5	12	4.3	18	2.9	17	3.9	25	4.0	23	4.6	31	3.2	29	5.5	44	3.1	59	4.9	79
117	9	1	94	2.7	6	3.6	13	2.8	16	3.7	23	2.9	11	3.6	19	4.5	38	6.2	48	2.7	51	4.8	78
118	9	1	80	2.1	2	3.6	13	2.5	12	3.1	19	2.8	10	3.1	13	2.1	15	2.2	16	2.8	53	2.8	52
119	10	0	69	2.0	1	3.2	16	2.2	9	2.2	9	2.4	6	2.7	9	2.6	23	2.1	15	2.3	40	2.6	48
120	8	11	79	3.2	10	3.3	11	2.7	14	2.4	11	2.5	7	3.0	12	2.0	13	2.8	25	2.3	39	2.5	44
121	9	7	75	2.5	4	2.5	4	2.7	14	2.9	17	3.1	13	3.7	20	1.8	10	2.5	21	2.5	44	2.5	45
122	9	1	96	3.3	11	3.0	8	2.9	17	2.8	16	3.9	22	3.3	15	2.3	18	2.4	20	2.0	32	2.6	48
123				2.7	6	3.5	12	1.0	4	3.0	18	2.4	6	2.5	7	3.1	28	3.0	27	2.0	33	2.8	53
124	9	6	67	2.7	6			2.5	12			2.7	9	2.8	10	2.0	14	1.9	12	2.4	42	2.5	45
125	10	3	89	4.9	21			4.0	26			4.0	24	4.4	28	4.5	38	3.7	33	3.5	66	3.4	65

. GROUP II: CONTROL

No.	AGE Yrs.	Mos.	IQ	WORD MEANING Pretest Gr. Eq.	WORD MEANING Pretest Raw Sc.	WORD MEANING Posttest Gr. Eq.	WORD MEANING Posttest Raw Sc.	PARAGRAPH MEANING Pretest Gr. Eq.	PARAGRAPH MEANING Pretest Raw Sc.	PARAGRAPH MEANING Posttest Gr. Eq.	PARAGRAPH MEANING Posttest Raw Sc.	SPELLING Pretest Gr. Eq.	SPELLING Pretest Raw Sc.	SPELLING Posttest Gr. Eq.	SPELLING Posttest Raw Sc.	WORD STUDY Pretest Gr. Eq.	WORD STUDY Pretest Raw Sc.	WORD STUDY Posttest Gr. Eq.	WORD STUDY Posttest Raw Sc.	LANGUAGE Pretest Gr. Eq.	LANGUAGE Pretest Raw Sc.	LANGUAGE Posttest Gr. Eq.	LANGUAGE Posttest Raw Sc.
126	9	5	82	3.0	08	2.9	07	2.9	17	2.6	13	3.1	13	2.8	10	2.2	17	1.8	11	2.3	40	2.5	43
127	9	6	90	3.3	11	2.6	05	3.9	25	3.8	24	3.0	12	3.2	14	2.4	20	2.7	24	2.6	46	2.9	56
128	9	6	86	2.3	03			2.3	10			2.8	10	3.4	16	1.8	11	2.1	15	2.7	51	2.6	47
129	9	4	74	3.2	11			2.9	17			3.4	16	3.0	12	2.1	15	1.7	09	2.5	43	2.6	46
130						2.3	03			2.4	11			2.8	10			2.0	13			2.5	43
131				3.5	12	3.1	09	2.5	12	2.8	16	2.9	11	3.1	13	2.7	24	2.6	22	1.2	15	1.1	12
132	10	6	79	3.0	08	2.9	07	2.8	15	2.9	17	3.5	17	3.6	18	2.4	19	1.9	12	2.4	41	2.4	41
133	10	11	68	3.6	13	3.5	12	2.7	14	2.5	12	2.7	09	2.7	09	2.3	18	2.6	22	2.2	38	3.3	63
134						4.9	21			3.1	19			4.3	27			3.3	30			2.7	51
135	8	11	72	2.6	05	2.7	06	2.7	14	2.7	14	3.4	16	3.4	16	1.9	12	1.9	12	2.7	50		
136	9	8	69	2.3	03	2.9	07	2.8	16	2.9	17	3.3	15	2.9	11	2.6	22	2.4	19	2.6	47	2.5	44
137	9	5	106	3.8	15	4.7	29	3.8	24	4.0	26	2.7	09	3.3	15	6.2	48	5.2	42	3.3	62	3.2	60
138	9	1	88	2.9	07	3.3	11	3.0	18	2.9	17	2.7	09	2.9	11	1.9	12	2.1	15	2.5	43	2.8	53
139	8	9	83	2.7	06	3.1	9	2.2	9	3.4	21	2.6	08	3.4	16	1.8	10	2.6	23	1.7	26	2.5	43
140	9	6	79	3.2	10	3.2	10	2.8	15	2.7	14	3.5	17	3.7	20	2.6	23	2.6	22	2.4	42	2.7	50
141	10	2	86	3.0	08	3.2	10	2.8	16	2.8	16	3.1	13	3.3	15	2.2	17	2.2	17	2.6	46	2.0	32
142	9	2	74	2.5	04	2.9	07	2.0	05	2.8	16	2.3	05	3.3	15	2.0	13	2.4	19	2.3	40	2.6	48
143	9	1	82	3.2	10	3.3	11	2.9	17	3.0	18	2.8	10	2.7	09	2.2	16	2.0	14	2.5	44	2.6	47
144	8	10	77	3.3	11	3.1	09	2.1	07	2.6	13	3.3	15	3.5	17	1.6	07	2.4	20	2.7	50	2.2	37
145	9	8	84	2.6	05	3.9	16	2.6	13	3.0	18	2.3	05	2.9	11	1.7	08	2.6	22	2.2	37	2.7	50
146	9	1	74	3.2	10	3.5	12	3.1	19	2.8	15	3.0	12	3.2	14	2.5	21	2.2	16	2.6	48	2.7	49
147	9	7	98	3.7	14	4.1	17	3.6	22	4.0	26	3.2	14	3.8	21	2.9	26	5.2	42	2.7	51	3.2	60
148	9	5	98	3.0	08	3.3	11	2.1	07	4.2	28	1.9	02	3.6	18	2.5	21	3.0	27	2.5	45	2.5	44
149	10	8	71	2.1	02	2.6	05	2.9	17	2.7	14	2.7	09	2.7	09	2.1	15	1.6	06	1.3	16	1.7	25
150	9	1	92	2.7	06			2.8	16			2.6	08	3.5	17	2.2	16	2.6	22	2.7	50	2.7	51
151	9	2	89	3.2	10	3.2	10	3.0	18	2.8	15	3.1	13	3.2	14	2.2	16	2.3	18	2.9	56	2.5	45

GROUP III: COMBINED

No.	AGE Yrs.	Mos.	IQ	WORD MEANING Pretest Gr. Eq.	Raw Sc.	Posttest Gr. Eq.	Raw Sc.	PARAGRAPH MEANING Pretest Gr. Eq.	Raw Sc.	Posttest Gr. Eq.	Raw Sc.	SPELLING Pretest Gr. Eq.	Raw Sc.	Posttest Gr. Eq.	Raw Sc.	WORD STUDY Pretest Gr. Eq.	Raw Sc.	Posttest Gr. Eq.	Raw Sc.	LANGUAGE Pretest Gr. Eq.	Raw Sc.	Posttest Gr. Eq.	Raw Sc.
152	9	4	72	2.6	5	3.1	9	2.6	13	2.3	10	2.7	9	2.8	10	1.9	12	2.0	14	2.1	34	2.5	44
153	9	4	67	2.6	5			2.2	9			2.5	7			2.0	13	1.6	6	1.9	30	2.6	47
154	10	6	52	2.3	3	3.1	9	2.2	9	2.8	16	2.5	7	2.7	9	2.4	19	2.3	18	2.2	37	3.0	57
155	9	4	95	4.9	21	6.1	27	2.0	6	4.0	26	4.0	24	3.5	17	6.0	47	4.5	38	4.2	73	3.3	63
156	9	9	83	2.7	6	3.7	14	2.8	15	2.2	8	2.5	7	2.9	11	2.2	17	2.5	21	2.0	33	2.4	41
157	9	4	91	2.6	5	2.9	7	2.8	15	3.2	20	2.4	6	3.4	16	2.1	15	2.9	26	2.0	32	2.8	53
158	9	8	79	3.3	11	2.7	6	3.6	22	2.8	15	3.0	12	3.0	12	2.5	21	1.8	11	2.5	43	2.7	50
159	9	2	79	3.2	10	8.9	16	2.9	17	3.9	25	3.5	17	4.4	28	6.2	48	6.3	49	2.9	55	5.5	84
160	9	8	87	3.2	10	3.2	10	2.2	9	3.0	18	3.6	18	3.7	20	2.2	16	2.6	23	2.8	52	2.6	48
161	9	1	69	3.6	13	3.2	10	2.8	15	2.8	16	2.2	4	2.5	7	1.8	11	2.4	20	2.4	41	2.8	54
162	8	10	85	3.5	12	3.3	11	2.7	14	3.2	20	2.7	9	2.9	11	2.4	20	2.6	13	2.1	36	2.5	45
163	9	0	82	2.6	5	3.6	13	3.0	18	2.8	16	2.5	7	3.5	17	2.3	18	2.3	18	2.3	40	2.3	40
164	9	1	82	3.2	10	3.6	13	3.2	20	3.4	21	3.2	14	3.4	16	3.2	29	2.5	21	2.8	54	3.4	65
165	9	8	71	3.2	10	3.1	9	2.3	10	2.8	15	2.9	11	3.6	19	1.5	4	1.7	8	2.1	35	2.6	47
166	10	8	71	2.1	2	3.1	9	2.9	17	2.8	15	2.7	9			2.1	15			1.3			
167	10	9	70	2.6	5	2.6	5	2.9	17	2.6	13	3.2	14	3.2	17	2.8	25	2.6	22	2.8	54	2.5	45
168	9	4	92	3.2	10	4.1	17	2.9	17	2.1	7	3.6	18	3.6	18	3.2	29	4.2	36	3.2	60	4.3	74
169	8	10	77	3.0	8	3.5	12	2.1	7	2.8	16	3.0	12			2.0	13			2.6	45	2.4	41
170	8	8	91	2.7	6	2.6	5	2.8	15	2.2	8	2.6	8	1.8	12	2.2	17	2.9	26	2.7	51	1.7	25
171	9	1	76	3.0	8	3.8	15	3.2	20	3.9	25	3.4	16	3.2	14	2.2	17	2.4	20	2.7	49	2.6	47
172	9	7	69	2.5	4	2.9	7	2.8	16	4.0	26	2.3	5	2.7	9	2.0	13	2.7	24	2.2	37	2.6	47
173	9	7	83	2.6	5	3.2	10	2.5	12	3.6	22	3.1	13	4.0	24	2.4	19	2.9	26	2.8	52	3.0	57
174	9	1	30	5.2	23	5.2	23	4.9	34	5.0	35	4.1	25	4.2	29	5.7	45	5.5	44	7.4	95	5.8	86
175	9	0	74	2.7	6	3.1	9	2.7	14	2.6	13	2.5	7	3.4	16	2.0	14	3.6	32	2.3	39	2.8	54

GROUP IV: INDIVIDUAL REWARDS

No.	AGE Yrs.	Mos.	IQ	WORD MEANING Pretest Gr. Eq.	Pretest Raw Sc.	Posttest Gr. Eq.	Posttest Raw Sc.	PARAGRAPH MEANING Pretest Gr. Eq.	Pretest Raw Sc.	Posttest Gr. Eq.	Posttest Raw Sc.	SPELLING Pretest Gr. Eq.	Pretest Raw Sc.	Posttest Gr. Eq.	Posttest Raw Sc.	WORD STUDY Pretest Gr. Eq.	Pretest Raw Sc.	Posttest Gr. Eq.	Posttest Raw Sc.	LANGUAGE Pretest Gr. Eq.	Pretest Raw Sc.	Posttest Gr. Eq.	Posttest Raw Sc.
176	9	4	91	3.6	13	3.5	12	2.7	14	3.2	20	2.7	9	3.6	19	2.2	17	2.9	26	2.2	37	3.0	57
177	9	7	85	2.9	7	2.6	5	3.0	18	1.9	3	2.5	7	3.3	15	2.1	15	2.2	16	2.7	49	1.5	22
178	9	5	82	3.3	11	2.3	3	3.1	19	2.0	6	2.2	4	2.0	13	2.0	13			2.0	31	2.7	49
179	7	9		2.5	4	3.5	12	3.1	19	2.3	10	3.6	18	2.9	11	2.6	23	2.3	18	2.5	44	2.7	50
180	9	3	76	2.1	2	2.6	5	2.3	10	2.8	16	2.0	3	3.8	21	2.3	18	2.9	26	2.0	33	2.2	38
181	9	9	74	2.7	6	2.5	4	2.5	12	2.8	16	3.4	16	2.3	5	1.9	12	1.8	10	1.9	30	2.1	36
182	8	9	75	2.6	5	3.5	12	2.4	11	2.7	14	2.0	3	2.7	9	2.2	17	2.4	19	2.0	31	2.4	42
183	9	8	107	3.9	16	4.7	20	4.2	28	4.6	31	3.8	21	3.9	22	5.0	41	5.8	46	3.7	68	4.0	71
184	9	3	67			2.6	5			2.8	16	2.6	8	3.5	17	1.8	11	3.1	28	2.3	40	2.1	35
185	9	3	88	2.7	6	2.6	5	2.5	12	2.9	17	3.1	13	3.1	13	1.6	5	2.0	13	2.1	36	2.6	46
186	10	9	54	3.1	9	3.1	9	2.9	17	2.7	14	3.0	12	3.1	13	2.4	19	2.3	18	2.3	29	2.7	51
187	9	6	61	2.3	3	2.9	7	2.0	5	3.4	21	2.2	4	3.0	12	1.6	5	2.4	20	1.6	24	2.1	36
188	9	2	88	2.7	6	3.1	9	2.9	17	3.7	23	3.2	14	3.7	20	1.6	5	2.6	23	2.4	42	3.0	57
189	9	9	76	2.5	4	2.7	6	2.6	13	3.6	22	2.7	9	3.4	16	1.8	10	2.4	20	1.6	24	2.5	45
190	8	11	62	2.3	3			3.0	18			3.0	12	2.6	8	1.8	10	2.0	13	2.1	36	2.9	55
191	9	4	70	2.5	4	3.6	13	2.8	15	3.0	18	3.2	14			1.7	8			1.7	26	2.5	44
192				2.1	2	3.1	9	1.8	2	3.6	22	2.4	6	3.6	19	2.2	17	2.1	15	1.6	23	2.7	49
193	9	8	107	4.7	20	5.4	24	4.2	28	4.8	33	4.0	24			5.0	41			3.8	69		
194	9	6	120	6.4	28	7.5	32	5.9	40	6.1	42	4.8	33	[illegible]3	37	5.7	45	5.3	43	6.4	89	6.5	90
195	9	8	75	2.7	6	2.0	1	2.7	14	2.5	12	2.7	9	3.4	16	2.4	19	2.3	18	2.3	40	2.3	39
196	9	5	65	2.3	3	2.6	5	2.8	16	3.1	19	2.7	9	3.0	12	2.5	21	2.6	22	1.6	24	2.6	47
197	9	7	84	2.5	4	2.6	5	2.7	14	2.8	16	3.1	13	2.4	6	1.8	10	2.3	18	2.5	44	2.8	54
198	8	9	92	2.9	7			2.9	17			4.2	26	5.4	38	4.6	39	5.5	44	3.6	67	3.9	70
199	10	5	67	2.0	1	3.8	15	2.0	6	2.9	17	2.0	3	3.2	14	2.0	13	2.4	19	2.2	37	2.6	46
200	9	2	82	2.5	4	3.5	12	2.0	6	3.6	22	2.8	10	4.7	32	1.8	11	2.0	14	2.9	55	3.1	59
201	8	11	72	2.6	5	3.0	8	2.0	5	2.9	17	2.6	8	3.0	12	1.6	6	2.5	21	1.4	18	2.5	43

GROUP V: GROUP REWARD

No.	AGE Yrs. Mos.	IQ	WORD MEANING Pretest Gr. Eq.	WORD MEANING Pretest Raw Sc.	WORD MEANING Posttest Gr. Eq.	WORD MEANING Posttest Raw Sc.	PARAGRAPH MEANING Pretest Gr. Eq.	PARAGRAPH MEANING Pretest Raw Sc.	PARAGRAPH MEANING Posttest Gr. Eq.	PARAGRAPH MEANING Posttest Raw Sc.	SPELLING Pretest Gr. Eq.	SPELLING Pretest Raw Sc.	SPELLING Posttest Gr. Eq.	SPELLING Posttest Raw Sc.	WORD STUDY Pretest Gr. Eq.	WORD STUDY Pretest Raw Sc.	WORD STUDY Posttest Gr. Eq.	WORD STUDY Posttest Raw Sc.	LANGUAGE Pretest Gr. Eq.	LANGUAGE Pretest Raw Sc.	LANGUAGE Posttest Gr. Eq.	LANGUAGE Posttest Raw Sc.
203	9-2	78	2.5	04	2.9	7	3.2	20	2.7	14	2.9	11	3.0	19	2.0	14	4.4	37	2.3	40	2.7	50
204	9-7	61	2.0	01	3.2	10	2.5	12	2.8	16	2.7	09	3.4	16	2.6	23	2.3	18	2.7	49	2.6	47
205	9-4	92	2.6	05	3.7	14	2.8	15	2.9	17	2.4	06	3.7	20	3.3	30	3.6	32	2.4	45	2.9	56
206	9-3	93	3.5	12	3.6	13	3.8	24	3.6	22	3.5	17	4.0	23	3.9	34	4,6	39	2.9	56	3.1	58
207	9-5	84	2.3	03	2.9	07	2.8	16	2.7	14	2.7	09	3.3	15	2.5	21	1.7	09	1.6	24	2.3	40
208	9-10	84	2.7	06	2.7	06	2.5	12	2.5	12	2.9	11	3.2	14	2.2	17	2.2	16	2.0	33	2.6	47
209	9-3	84	2.6	05	3.0	08	2.3	10	2.5	12	3.3	15			1.8	10			2.0	33		
210	9-2	76	2.5	04	3.3	11	3.0	18	3.2	20	2.7	09	4.1	25	2.5	21	3.3	30	2.1	36	2.7	50
211	7-10		4.3	18	4.7	20	3.2	20	4.4	30	3.9	22	4.8	33	3.2	29	4.2	36	2.9	56	4.4	75
212	9-1	84	2.6	05	2.6	05	2.1	07	2.4	11	2.9	11	3.1	13	1.7	09	2.2	17	2.3	40	2.7	49
213	8-10	91	2.9	07	2.5	04	3.2	20	2.9	17	3.1	13	2.9	11	2.8	25	2.2	17	2.3	39	2.6	48
214	9-8	64	3.2	10	4.1	17	3.2	20	2.5	12	2.6	08	2.5	07	2.2	16	2.4	20	2.4	42	2.7	49
215	8-10	74	2.6	05	3.3	11	2.2	09	2.8	16	2.6	07	3.1	13	2.0	13	2.2	16	2.2	37	2.3	40
216					2.6	05			3.0	18			2.9	11			2.2	17			2.8	53
217	9-3	94	2.7	06	3.3	11	2.6	13	3.4	21	4.0	23	4.0	23	3.9	34	4.2	36	1.8	27	4.1	72
218	8-11	106	3.0	08	2.9	07	2.2	09	2.0	06	3.3	15	3.6	19	2.2	17	4.0	35	2.6	48	2.8	52
219					4.9	21			4.1	27			2.5	07			4.5	38			3.2	61
220					3.2	10			2.7	14			3.2	14			2.4	19			3.1	58
221	9-0	89	3.6	13	4.6	19	3.2	20	3.7	23	3.4	16	4.9	34	2.8	25	2.9	26	2.7	51	3.3	62
222	8-1	129	4.6	19	7.0	30	6.1	42	7.2	47	4.5	29	4.6	30	3.9	34	4.0	35	4.1	72	5.2	82
223	10-5	64	2.6	05	3.2	10	3.0	18	2.2	09	3.0	12	2.9	11	1.9	12	2.2	16	2.5	34	2.6	47
224	9-0	95	2.0	01	3.6	13	1.9	04	3.8	24	2.3	05	3.0	12	2.3	18	2.4	19	1.6	24	2.7	50
225	9-1	76	2.9	07	4.1	17	2.7	14	3.1	19	3.1	13	3.5	17	2.6	22	2.9	26	2.0	32	2.6	46
226	9-3	74	2.0	01			2.9	17			3.3	15	3.1	13	2.4	19	2.4	20	2.5	44	2.7	50